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MT. KITCHI: A NEW PEAK IN THE CANADIAN ROCKIES*

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(Map facing p. 496.)

During six weeks of the past summer (1914) I made an expedition into the Canadian Rockies of Alberta and British Columbia, northwest of Mt. Robson. My companions were Miss Margaret Springate, of Winnipeg, a member of the Canadian Alpine Club; Donald Phillips, the chief guide of the expedition, who in 1909, with the Rev. G. B. Kinney, made the first ascent of Mt. Robson; and a second guide, Bert Wilkins. We explored an area near the continental divide between 118¾° and 120¼° W. longitude and between 53° and 54° N. north latitude. Our point "farthest north" was on the watershed of Fraser tributaries about 85 miles in an air line northwest of Robson station, and, by trails largely of our own making, nearly twice that distance.

On July 30th we left Grant Brook station on the Grand Trunk Pacific Railway. We traveled with an outfit of four saddle horses and four pack horses along the Moose River, a three days' journey to Moose Pass. From Moose Pass on August 2nd we climbed Mt. Pamm,[1] an easy snow peak less than 10,000 feet, and situated 12 miles north-northeast of Mt. Robson. Here on the summit with the aid of glasses we had our first glimpse of Mt. Kitchi. It rose a great, white pyramid, shining out through the distant haze to the northwest, and lifting its glaciated head far above the black peaks

* All the photographs were taken by the author; copyright, 1914.

1 Name not confirmed by the Geographic Board of Canada.

of its immediate environment. During the past year or so the existence and exact location of this "Big Mountain" have been matters of much interest to alpinists familiar with the Mt. Robson country. This peak was our summer's quest.

Our compass bearings showed the "Big Mountain" to be almost on an exact northwest line from Mt. Robson and also on a line with Mt. Bess[2] and Mt. Chown.[2] These last-named peaks are about 20 miles north-northwest of Mt. Robson. These readings from Mt. Pamm served as our guide during the early part of the trip. It was impossible to estimate at this time the distance of the peak north of Mt. Robson. It seemed perhaps 80 to 90 miles away, but that was a mere conjecture.

In the days of the early survey a Grand Trunk Pacific engineer named Jones traveled along the continental divide from the northeast, approximating the location of the mountain as well as Fraser tributaries from the divide itself. The "Big Mountain" had been seen by Prof. J. Norman Collie and Mr. A. L. Mumm at the time of their ascent of Mt. Bess in 1911. Fred Stevens, a pioneer, in company with two other men, had reported in 1912 the existence of a big snow mountain which they had seen while locating timber limits on one of the northern tributaries of the Fraser. The same year Mr. S. P. Fay of Boston had seen the peak from the headwaters of the Porcupine. The summer of 1913 members of the Canadian Alpine Club—Donald Phillips and others—had seen a great, white peak while climbing on and about Mt. Robson. However, so far as we were able to secure information from the Canadian authorities, no one except Donald Phillips had attempted to explore the region lying northwest of Mt. Bess in the Fraser watershed. In 1912 and 1913 he had explored the Beaver in the Fraser Watershed, and also the Big Smoky and the Jack Pine rivers in the Peace watershed and had made a sketch map of that region.

With this information as our basis we left Robson Pass camp August 7th and started north along the Big Smoky, a large tributary of the Peace, which heads in the Robson glacier. The first four days out there was a trail extremely rough but more or less distinct down the Smoky, up Bess Pass, where our aneroid registered 5,500 feet, over Bess Shoulder, 6,400 feet, and up Jack Pine Pass, 6,500 feet, to the headwaters of the Jack Pine. Old Salamo, an intelligent Indian from Grand Cache, had hunted in these regions

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[2] Names not confirmed.

years before and he had an engineer's eye for routes of least resistance, though portions of them lay over snow-line passes. However, the descent on the north side of Jack Pine Pass was the steepest place I had at that time ever seen horses traverse. With goatlike sureness of foot the cayuses zigzagged down a 40 degree slope at a terrific speed, marvellously maintaining their balance. It was exciting, but the return trip across Jack Pine Pass four weeks later seemed an every-day occurrence. We had learned something in that interval.

The vista down the Jack Pine is one which memory will always picture. To the east the glaciated walls of Mt. Bess and Mt. Chown rise perpendicularly from the long sloping banks of the river. From these ice masses wild, swollen streams fall to the valley below. To the west is a long range of wooded mountains with many gleaming waterfalls shining out against a dark background of spruce and jack pines. Topping this ridge is a vast stretch of flower-filled alpland dotted with many lovely dark lakes. The Jack Pine itself is a curious stream. When our horses forded it, we noticed two distinct streams of water, the one white and muddy rushing from the glaciers on the east side; the other clear and blue pouring from the little lakes and waterfalls on the west side of the valley.

Beyond our Jack Pine camp at the foot of the pass, the only trail is a snow-shoe trail which Phillips and Frank Doucette, his trapping partner, made in 1911. About an hour down the Jack Pine we came to one of their old caches where we expected to find flour, rice, and butter, but the robber wolverenes had destroyed everything to the last morsel. This was a considerable loss to us and put us on rations much more quickly than we had anticipated.

Beyond the head of the Jack Pine we had fearful going. For hours we waded on foot through muskeg too soft to hold up our horses; we plunged through streams up to our knees, and then fell through thickets of alders twelve feet high. The rain beat down steadily and we were steaming hot under our rubber coats, and at the same time drenched to our waists. After ten maddening hours of trail cutting and muskeg, we made camp on a little island surrounded by two channels of the river. There was no brush for our beds and the firewood had to be chopped on the other side of the river and carried across.

The next day we followed a well-defined game trail filled with hundreds of tracks of moose, caribou and bear. As we left the valley of the main Jack Pine and struck for the head of the Middle-

Fork, the ridges became very steep and the undergrowth extremely dense, the nearer we approached the British Columbia line. Gnarled and twisted spruce and jack pines and willow scrub filled the lower valleys. Higher up on the mountain sides we encountered rhododendron thickets so compactly massed and inclined downward by the pressure of the winter's snows that climbing against them was almost intolerable. When we reached the pass (Jones Pass), 6,200 feet, between the Middle Fork and the West Branch of the Jack Pine we were practically at the end of Phillips' knowledge of the country. It was necessary for us to locate, if possible, our peak, and get bearings and landmarks for the remainder of the journey. From our camp, Phillips and I climbed a nearby ridge to an observation peak, 7,600 feet according to the aneroid. Here we photographed the landscape on all sides. To the southeast Mts. Robson, Whitehorn, Resplendent, and Pamm (our first locating climb) were plainly visible; west of northwest two black peaks (we called them the Black Twins) were prominent in the foreground. Our course was correct, for the Big Mountain, now much farther off than Mt. Robson, we saw quite distinctly north of northwest of these twin peaks. For several days succeeding, as our course was to the north of these peaks, they continued to be an unmistakable landmark. From our Jones Pass peak station the Big Mountain, with its great snow and ice abutments, was more prominent than any other feature of the northern landscape. Great tumbling glaciers everywhere surrounded it. The summit seemed a long, knife-like arête with a long slope to the southwest and another to the northeast. Through the glasses the south face appeared extremely difficult. As is usually the case in these ranges, we found the north face equally difficult. From this station all the main ranges lie northeast and southwest. There were only four ranges visible to us between Jones Pass and the Big Mountain. Instead we crossed eight later on and at this point we were less than half way.

We were in the midst of wild country. In the space of one hour we were within easy range of a black bear, a big bull moose, and a flock of mountain goats.

From Jones Pass we cut our way through dense woods down a steep declivity to broad open muskeg on the West Branch of the Jack Pine. After traveling about six miles through this meadow we came to a low pass, 5,300 feet, filled with beaver dams and houses. We named this pass Beaver Dam Pass. It separates Fraser and Peace waters. Another broad stretch of muskeg and

we reached another pass, on which a huge avalanche of trees and rocks had descended. At Avalanche Pass our aneroid registered 5,300 feet. Our further progress was here checked by dense woods filled with an undergrowth of devils' club and rhododendron of the British Columbia variety. In fact, from here on every timbered ascent or descent meant most serious and exhausting exertion for both man and cayuse. I think it impossible to take cayuses over steeper, rougher places than we traversed during the remainder of our trip to the Big Mountain. The northern side of Jack Pine Pass, which had seemed a thrilling descent when we had crossed it several days before, now, in comparison with these British Columbia mountains, seemed like an hour's pastime.

There was no chance to move our outfit through such a maze. A less hardy and determined guide would have pronounced it the end of our journey. But for twelve long hours, Phillips and Wilkins cut out a trail over the mountain to a blue-green river, while Miss Springate and I, in true squaw fashion, prepared a wonderful dinner (it was the anniversary of Phillips' ascent of Mt. Robson) and kept the horses from straying from camp. The next day we moved our outfit over a mountain shoulder, 6,150 feet, and down to the 'East' Branch of the Little Smoky, 4,600 feet. The flats of the Little Smoky are filled with beaver houses, dams, trails half a foot deep and cuttings, while in the forest adjacent we found moose trails as well worn as any pack trail. In some places they were worn down two feet below the natural, mossy surface.

To cross the next mountain our men cut out twenty-four switchbacks in making three-quarters of a mile of trail—a twelve hours' job. The open Jack Pine forests of Alberta were indeed far away. We got up the switchback trail in one and one-half hours, and then struck alpland with a long ridge beyond. We found a pass at 6,400 feet near a beautiful crescent-shaped lake. We camped at tree line (5,900 feet) below "Crescent Lake Pass." From a peak north of the pass Phillips discovered another pass, and mapped out the morrow's route over alpland.

The weather had continued fine from the second day out. A brief thunderstorm at midnight at the Crescent Lake camp August 15th was followed by sharp, clear sunshine the next day, which showed us a fine wide pass across a 6,000 foot snow field to the north-east of our old landmarks, the Black Twins; we named this pass Eagle Pass. Golden eagles were flying about in great numbers and the ground was strewn with feathers. Before us stretched out

a great alpine basin, probably fifteen square miles in area, presenting a wonderful vista of soft, sweet alpine grass, multi-colored alpine flowers, and low-growing balsams. Two miles beyond Eagle Pass we crossed a tributary of the 'West' Branch of the Little Smoky. Two miles beyond this stream we came to what seemed an easy pass—at 6,500 feet. As the other side proved to be only cliff, scree and rock-fall, we turned west, crossed two more alpine summits in four miles. The latter, at 6,400 feet, was snow filled, while the slopes leading up to this pass were blue with forget-me-nots. Below Forget-me-not Pass, we had four hours of maddening trail cutting down a rhododendron descent of 1,500 feet, so steep

FIG. 3—Alpland above Avalanche Pass. Looking northwest.

that the pack horses trod constantly upon each others tails. Once out of the dense timber, the sun beat down fiercely upon us. Through willow scrub we followed moose tracks so recent that where they crossed the stream the water was still muddy in their foot prints. After searching for hours for a camp ground and feed for our horses, we came at last upon a beautifully clear stream—another branch of the Little Smoky—and pitched our tents on an old Indian camp ground. The tepee poles were grass grown and rotten, left there years before doubtless by roving Crees who had come in from Grand Cache by the Muddy Water river. We called this stream Forget-me-not Creek, as it drains Forget-me-not Pass. It was reached, moreover, after a memorable day of hard trail work.

The next day we crossed Forget-me-not Creek and traveled all

day over rhododendron and scrub balsam ridges and side hills, coming at night to Last Hope Camp, 5,500 feet. There was grave doubt about our taking our horses any further as all of the ridges and passes were dropping off abruptly on the north side and our observations at Crescent Lake Pass had shown us still several days of hard travel from our objective point.

From a peak above Last Hope Camp Phillips discovered a pass to the northwest. The next day we took our outfit over the snow of Last Hope Pass, 6,000 feet, and down 1,500 feet over steep sliding shale. It was a perilous undertaking. Less skill in picking out the zigzag route or less sure-footed animals might have cost us the

FIG. 4—The Black Twins. Looking west from north of Eagle Pass.

loss of a horse and, as a result, the defeat of our project. However, they had beaten out a trail over which they could return. It would have been impossible to have taken them up this shale slope without such a trail. Looking back at the mountain from two miles below, the route over which we had come seemed impossible. Our tracks, however, were easily discernible through the glasses.

The next day we crossed three ridges, each of which still bore traces of snow, and afforded all the impediments of hard going of the usual type. Below this last ridge, on a small stream flowing into Black Bear Creek, we halted our outfit for the last time. It was impossible to take our horses further. We made a permanent base camp and turned our horses out in a 250-acre meadow to graze.

On August 19th, our difficult work had just begun. Rugged,

wild country lay between us and the Big Mountain, that we knew; how vast and how difficult we could only imagine. Our last hope of reaching it was to "back-pack." Accordingly, we took four days of "grub," our personal and climbing outfits on our backs and plunged into the unknown. Miss Springate and I each carried an eider-down quilt, our personal belongings, and our cameras—fifteen pound packs—while the men carried 30 to 40 pounds. We took a small silk shelter tent, but the men had only a thin canvas bed cover between them, in lieu of a blanket. One frying pan, two small pails, four cups, and four spoons were the sum total of our kitchen outfit. I allowed myself the luxury of one cake of soap and a tooth

FIG. 5—Range between Black Bear Creek and Big Salmon River, taken from Last Horse Camp, looking northwest. Providence Pass is the saddle in the background at the extreme right.

brush; two oranges and six lemons I carried for the climb, but a towel and a change of clothing were forbidden. We cached our main outfit under the big tent fly and left behind us on a blazed tree a statement of our route and destination.

We hoped to reach the base of the mountain that night. However, we did not reckon on traveling through even thicker scrub and underbrush. We now struck dense alder thickets, and devil's club in full leaf and higher than our heads. To avoid these we traveled in the beds of small streams, but after a while the supply of streams gave out. We forded Black Bear Creek, in two and one-half feet of water, and then struck hard climbing on the mountain beyond, thick scrub interspersed with stiff cliffs. Our packs were

heavy, there was no sign of water, the heat was intense, and our progress was slow. Near the top we found a tiny trickling stream, from which we collected a few spoonfuls of water in our rubber drinking cups. We had had no water during six hours of hard climbing. Ascending a rocky ridge we came out above tree line into a rock-filled amphitheater, from which the Big Mountain, with its numerous glaciers and adjacent rock towers, was distinctly seen, but still another ridge and valley separated us therefrom. Crossing about two miles of rock-fall we scrambled over a long treeless ridge and beheld without interruption the great bulk of Mt. Kitchi. A giant ice peak rose from a massive base of rock. As we looked at

FIG. 6—View of Mt. Kitchi looking north-northwest from the northern slope of the range shown in Fig. 5. The main peak appears above the amphitheater which is flanked by the Two Towers on the right.

the mountain from the south-east, two conical rock towers, whose multi-colored rocks glistened in the evening light, were in the north-eastern foreground, while just beyond them we caught a glimpse of a long flowing glacier. Fifteen hundred feet below us, a torrential glacial river wound tortuously off to the south-west. It was the South Fork of the Big Salmon, and is formed by three converging branches which have their headwaters in the large glaciers on the north-east side of Mt. Kitchi. That night we made camp at tree line, as our progress in the direct line toward the mountain was now hindered by steep cliffs. Making a detour to the west, the next day, we followed an opening in these cliffs down an almost perpen-

dicular slope, well-forested with rhododendrons and devil's club, to the valley of the Big Salmon. This additional day consumed in reaching the base of the mountain put us on rations. One large "flapjack" was our luncheon allowance. It was amazing how that flapjack cheered us and stayed "by us" during the six and one-half hours of our afternoon's march. Traveling up the valley, we crossed two of the large northeast tributaries of the Big Salmon, the one on a log jam, the other on a tree Phillips felled.

We intended to camp on the terminal moraine of the east glacier. It runs right in to the timber, and obtaining fuel would have been easy. An approaching thunderstorm made camp necessary when we were about a mile below the moraine. We barely got the little silk shelter tent up and our packs inside when the storm broke. All night the rain and snow fell. The next day was an impossible one for climbing. The rain stopped at three and Phillips went out to reconnoiter. He felled a tree across the river (the main branch of the South Fork of the Big Salmon), which was still too powerful to ford even at this proximity to its source, and crossed the east glacier to look out a route, for our proposed climb on Mt. Kitchi on the morrow. The south and east faces of the mountain rise over 2,000 feet perpendicularly from hanging glaciers. These hanging glaciers on the main peak itself and on the north side of the Two Towers constantly avalanche on the long flowing east glacier. This east glacier is about two and a half miles from east to west, and two miles from north to south. It is everywhere deeply crevassed. The aneroid registered only 4,000 feet at the base of the terminal moraine, thus showing the ice to descend 1,500 feet lower than at Mt. Robson. At a distance this long flowing east glacier had seemed the feasible line of attack, for there the cliffs had not been visible. Obviously, another route must be selected. We hoped that the north and west slopes might be climbable. This hope was not founded on our observation of the mountains in this region, for the north side is always the difficult one. Phillips returned at ten o'clock, stating that he was able to locate a route only to the base of the last peak. What lay beyond, he could only conjecture.

The next morning, August 22nd, dawned cloudy. We started at 6 A. M. and after crossing two miles of deeply crevassed glacier came out on a long moraine. From this we climbed on the north-east side over rock-falls and cliffs to the northeast glacier. Shortly before reaching the second glacier it began to snow. We put on our extra sweaters, mittens, and caps. For two hours we traveled

very carefully over the glacier, hoping that the storm would cease. Instead it snowed the harder. Climbing became dangerous and we turned back at 7,000 feet, having climbed 2,900 feet from our camp. We were encased in ice at this elevation, and by the time we reached camp we were drenched to the skin. As "back packing" does not admit of the luxury of a change of raiment, we dried out by the fire. It cleared at 11 P. M.

We were now on very short rations, but near camp had killed six ptarmigan and that made possible the thought of climbing again on the morrow. However, at 6 A. M. a light rain was falling, and it was snowing hard on the mountain. Our immediate return to

FIG. 7—Providence Creek, showing Mt. Kitchi in the distance. Looking west.

our base camp was imperative. Although there were signs of all kinds of big game around us, they had effectually vanished at our approach. Our homeward trip through rain-soaked underbrush was melancholy. My one hope was to kill some game and return for another attempt on the mountain. At noon we had eaten everything but a little flour, tea, and four slices of bacon. We went home a different route, crossing the east branch of the South Fork of the Big Salmon three or four miles above the log jam. About 5 P. M., after climbing 1,500 feet up the worst rhododendron mountain yet encountered, we were fortunate enough to kill a caribou, which supply made possible another attempt on the mountain.

However, as Wilkins had developed rheumatism in his shoulder it was decided that he should continue to the main camp. Miss Sprin-

gate had not attempted to climb on the previous trip, and now, although keen for the experience of a second expedition to the base of the mountain, she graciously abandoned any idea of going back when she was aware that it would be impossible for Phillips to pack supplies for three. It was her unselfish spirit displayed at the critical moment which made possible the exploration of Mt. Kitchi.

Phillips and I accordingly returned to our old camp, having cut down our packs to the last ounce. We took with us the four slices of bacon, and part of the tea and flour, but our main food supply was the freshly killed caribou. *We had no salt.* Instead of carrying the silk shelter tent, we strung up the piece of canvas as a windbreak and slept by a fire.

At daybreak on August 25th we began our climb, following our old route across the east glacier, over the moraine and thence across the cliffs to the second glacier. Going beyond the point at which the storm had driven us back, we found the second glacier of vast extent, very steep and deeply serrated with crevasses, some of them being twenty feet in width and easily fifty feet in depth. This second glacier is flanked on the north by a constantly avalanching hanging glacier, while it in turn breaks off above the east glacier. Before making this second attempt I had questioned the advisability of climbing with only two on the rope. Phillips had replied, "We'll keep fifty feet of rope between us and if I get into a crevasse not more than four feet wide, I can cut steps and climb out." Few of the crevasses were more than fifty feet deep. Consequently, in case of a fall into a crevasse, the fifty feet of rope would admit of my untying my end of the rope, of anchoring my ice axe, and of tying the rope securely to the ice axe so that Phillips could cut steps and climb out of the crevasse. We did keep fifty feet of rope between us, and so traveled up that wonderful glacier. On either side of us were great ice walls, 500 to 1,000 feet high, blue and crevassed from foot to top. This northeast glacier, where it breaks off above the east glacier, assumes at its terminus most curiously fantastic shapes. Many of these seemed like colossal animals sitting in a row. We named it the Menagerie Glacier. We crossed the northeast glacier, reaching an elevation of 7,800 feet. At this point we had our first view of the northwest face of the mountain. Instead of the long snow slope we had anticipated, the peak shoots up into the sky, a sharp pinnacle of ice and rock like an elongated church steeple. Two bands of rock cliffs with numerous chimneys extend across the northwest face; between these is a constantly avalanch-

ing ice and snow slope. Above the second band of cliffs is a mass of ice, broken by crevasses and seracs. Through the glasses it showed blue-green with long icicles depending across the caverns. The arête leading from our point of observation is everywhere knife-like and broken.

We could easily have climbed 800 feet further, but as that would have been futile we built a cairn at 7,500 feet, and returned to our camp after having spent fourteen hours on the mountain.

The last peak rises probably 2,500 feet above the base of the first cliffs. From its northwest face a long, flowing glacier extends for about two miles. Above it on the long west ridge adjoining the mountain are numerous hanging glaciers. This watershed leads to a deep valley with a broad river flowing through to the southwest. Through the glasses it looked easily 500 feet wide, and is without doubt the main branch of the Big Salmon. Below the southeast slopes are the two glaciers already mentioned (the ones we crossed on our climb), while the long ridge to the south holds small hanging glaciers. One peculiarly characteristic feature of the mountain is the two big rock towers on the east side. They are of slightly different height, and are separated by a sharp rock pinnacle (mitre shaped). To the north of Mt. Kitchi, and probably ten miles away, is a sharp snow peak, possibly a 10,000 foot mountain. It is the peak marked "Mt. Ida" on the Grand Trunk Pacific map. We saw this peak from "Mt. Pamm," and several times thereafter on our trip. Across a pass to the northeast of Mt. Kitchi are two lovely clear-water lakes, each apparently a mile in length.

Heretofore, practically everyone who has seen Mt. Kitchi has estimated it at 12,000 or 12,500 feet. We have estimated its elevation at not more than 11,000 feet. When we stood at the base of the last peak, our aneroid registered only 8,000 feet. It is doubtful whether the main peak is more than 3,000 feet above this point of its surrounding ice and rock abutments. The mountains in its immediate environment are low; the snow line is 4,000 feet, consequently these two facts alone lead one to an exaggerated estimate of the height of the mountain, especially if the observations are made at a distance.

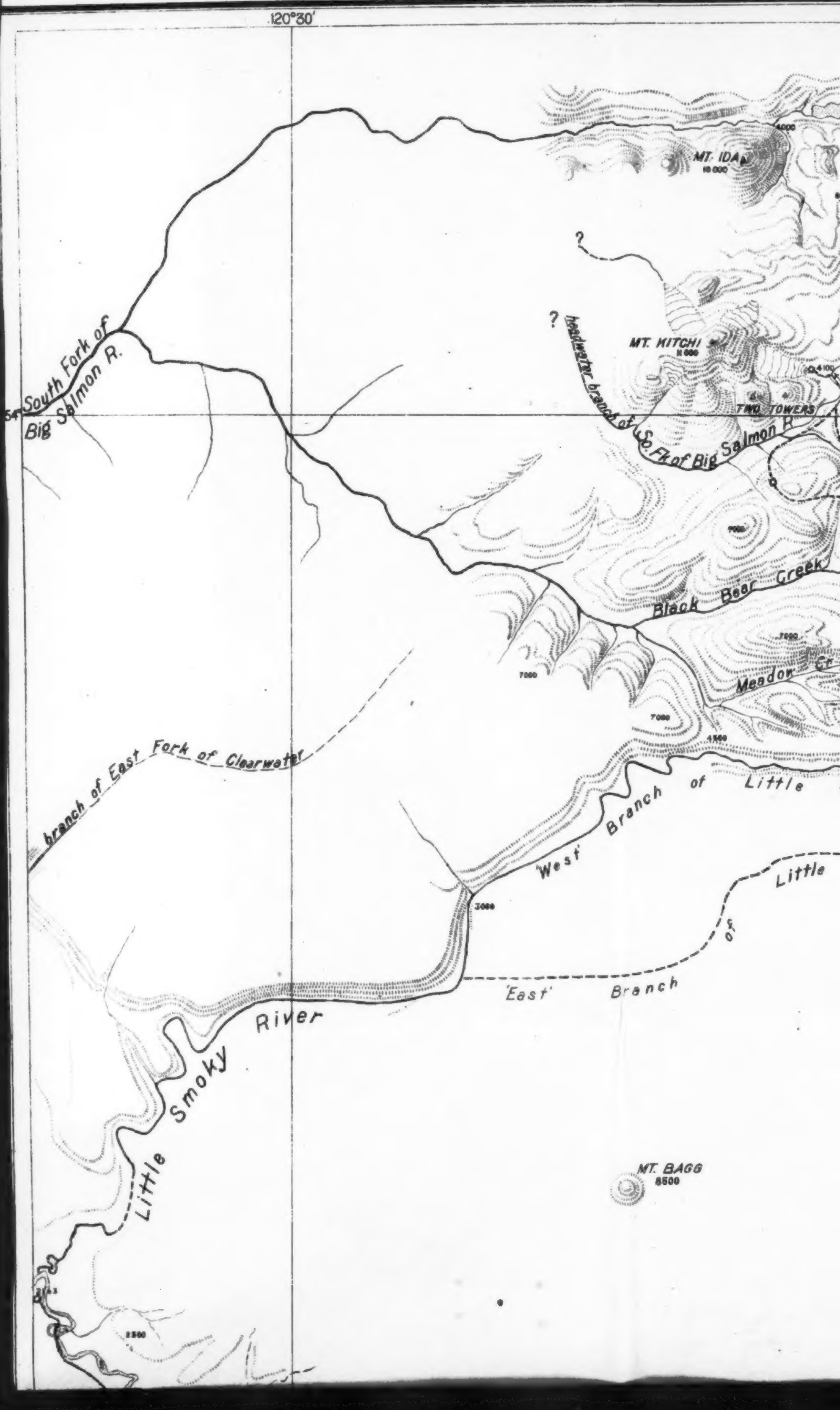
Mt. Kitchi is not only supreme in its immediate environment, but it has points that make it notable among mountains in general. Frequently, high mountains are surrounded by other mountains only slightly less in elevation; but Kitchi rises impressively above all nearby peaks. It is between 2,000 and 3,000 feet higher than

the neighboring peaks, while its only rival, "Mt. Ida," nearly six miles distant, seems more than 1,000 feet lower. Standing out boldly near the northwestern edge of the Rockies, this "last sentinel" of the North faces on the one side the deep valleys of the two branches of the Big Salmon, and on the other the low mountains merging into the blue foothills of the Peace. The lower half of the mountain rising from the Big Salmon as seen from the southeast is built of well-defined strata of reddish brown rock, in many places nearly horizontal; in others, deeply twisted and acutely slanted. The upper half is a sheer snow peak, broken occasionally by bands of rock over which the snow and ice constantly avalanche. No side of the mountain is free from these avalanches. The Two Towers, rising as abutments on the southeast and separated from the main peak by glaciers, are sheer, beautiful, and unique. The little mitre between the two towers is not unlike the "Mitre" in the southern Canadian Rockies, near Mt. Lefroy. In the Big Salmon valley, the Two Towers cut off the view of the summit, but two miles from the source of the river, one sees the main peak rising above the long flowing glacier to the north of the Two Towers, as an irregular pyramid. From the east and the northeast glaciers, the mountain assumes the form of a ridge, the knife-like edge of which is the sky line. The glacial area surrounding the mountain we estimated at 35 square miles, while its location is approximately 120°10′ W. and 54° N.

In conclusion: I wish to say that the main factors in our success in exploring the new country between the headwaters of the Jack Pine and Mt. Kitchi, and in exploring Mt. Kitchi itself, were the splendid ability, unflinching courage, and determined effort of Donald Phillips.

Note on the Map

To accompany her article Miss Jobe had originally prepared a sketch map, based on her and Donald Phillips's observations, which, while showing remarkably well the essential features of the country, did not partake of the nature of an instrumental survey. Subsequently an unpublished blue-print map of the Grand Trunk Pacific Railway (1a in appended list of maps) came to her knowledge, which showed in contours the topography of the whole mountain region between Jarvis Pass and the transverse courses of the Jack Pine and Smoky Rivers and its relation to the Fraser valley. Recognizing that this was a much more satisfactory representation, being based on an instrumental survey, it was decided to use it, together with all other available sources, in the compilation of a new map. As the blue-print map contained no geographic coordinates, it was necessary to supply them. This was done by drawing the parallel of 53° and the meridian of 119° in their proper positions as deduced from the known astronomic position of the township and range lines shown on the Yellowhead sheet of the Sectional Map of Western Canada (7) and from them expand-

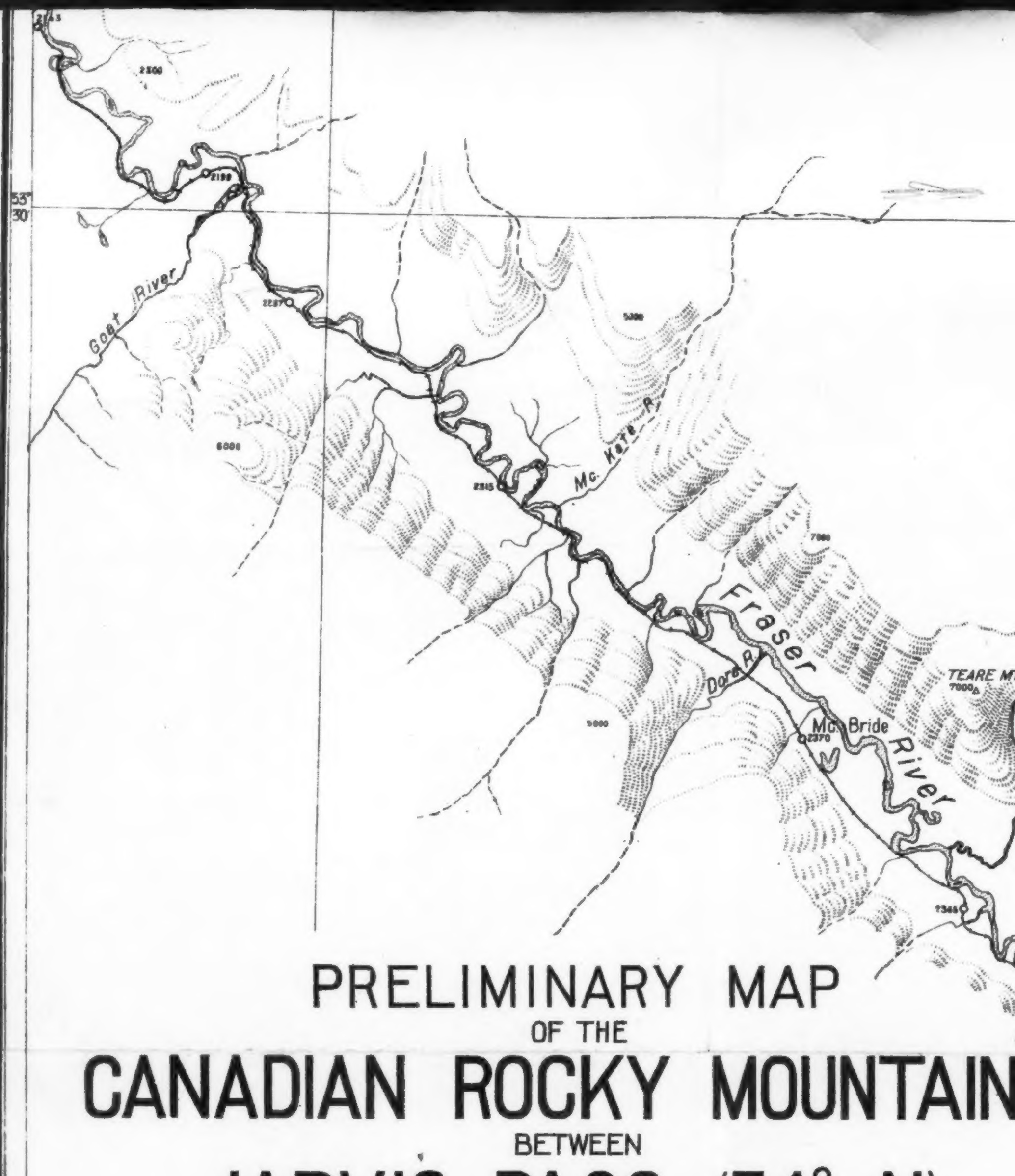


120°30'
54°
South Fork of Big Salmon R.
MT. IDA
10 000
MT. KITCHI
11 000
TWO TOWERS
headwater branch of So. Fk. of Big Salmon R.
Black Bear Creek
Meadow Cr.
branch of East Fork of Clearwater
West Branch of Little
Little
'East' Branch
Little Smoky River
MT. BAGG
8500
7000
4500
3000
2300

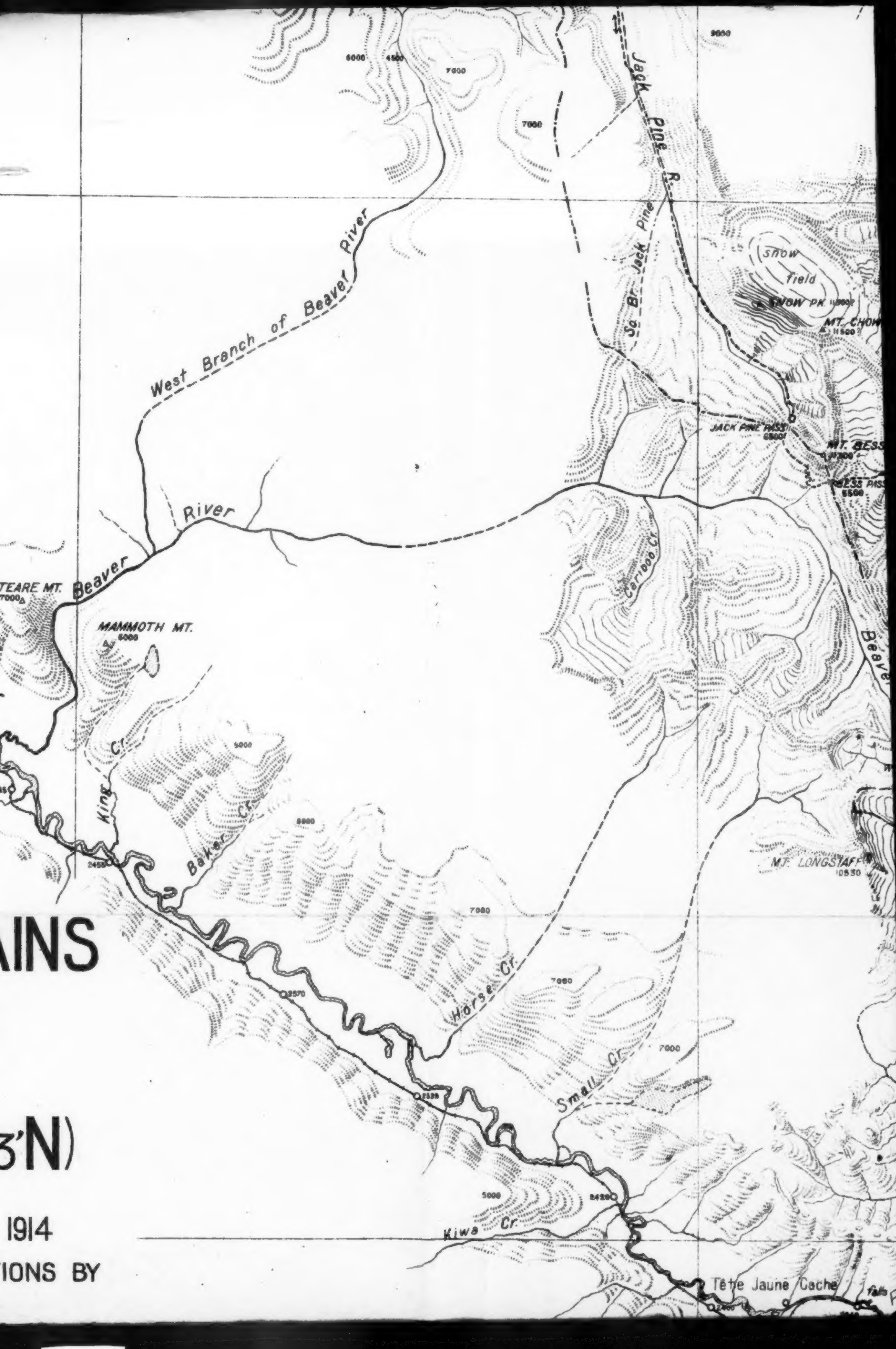
120°
119°30'
Porcupine River
Copton Creek
JARVIS PASS
TOWERS
PROVIDENCE PASS
SHEEP CREEK PASS
Creek
LAST HOPE PASS
(Forgetmenot Cr.)
Smoky
Little Smoky
Muddy
EAGLE PASS
CRESCENT L. PASS
BLACK TWINS
AVALANCHE PASS
5300 (5100)
BEAVER DAM
PASS 5300
W. Br. of Jack Pine
Jack Pine
JONES
PASS
6200
Middle Fork
MEADOW L. PASS
5400
Meadow
Lake
Jack


119°30'
119°
Copton Creek
River
Smoky
Sheep Creek
Horn Cr.
Muskeg
Grand Cache Lakes
Sulphur
River
Muddy Water River
Jack Pine River
Summit L.
Cutbank Cr.
Jack Pine
Fork
No Luck Cr.
Hardscrabble Cr.
Ptarmigan Lake
Smoky
River
Rockslide
Sulphur
Jack


118°30'
54°
River
West Fork of Simonette River
Little Smoky River
Muskeg River
River
Muskeg River
River
Baptiste River
Sulphur R.
6500
6000
6000
5000
4800
4000
5000
5000
6500
5000
6500
7500
6500
7500
7000
6500



PRELIMINARY MAP
OF THE
CANADIAN ROCKY MOUNTAIN
BETWEEN
JARVIS PASS (54° 9′ N)
AND
YELLOWHEAD PASS (52° 53′ N
SHOWING
THE ROUTE FOLLOWED BY MARY L. JOBE IN AUGUST 1914
COMPILED FROM AVAILABLE SOURCES, WITH CORRECTIONS AND ADDITIONS
MARY L. JOBE AND DONALD PHILLIPS


West Branch of Beaver River
Beaver River
Jack Pine R.
So. Br. Jack Pine
Snow field
SNOW PK
MT. CHOW
JACK PINE PASS
MT. BESS
BESS PASS
Cariboo Cr.
Beaver
TEARE MT.
MAMMOTH MT.
King Cr.
Baker Cr.
Horse Cr.
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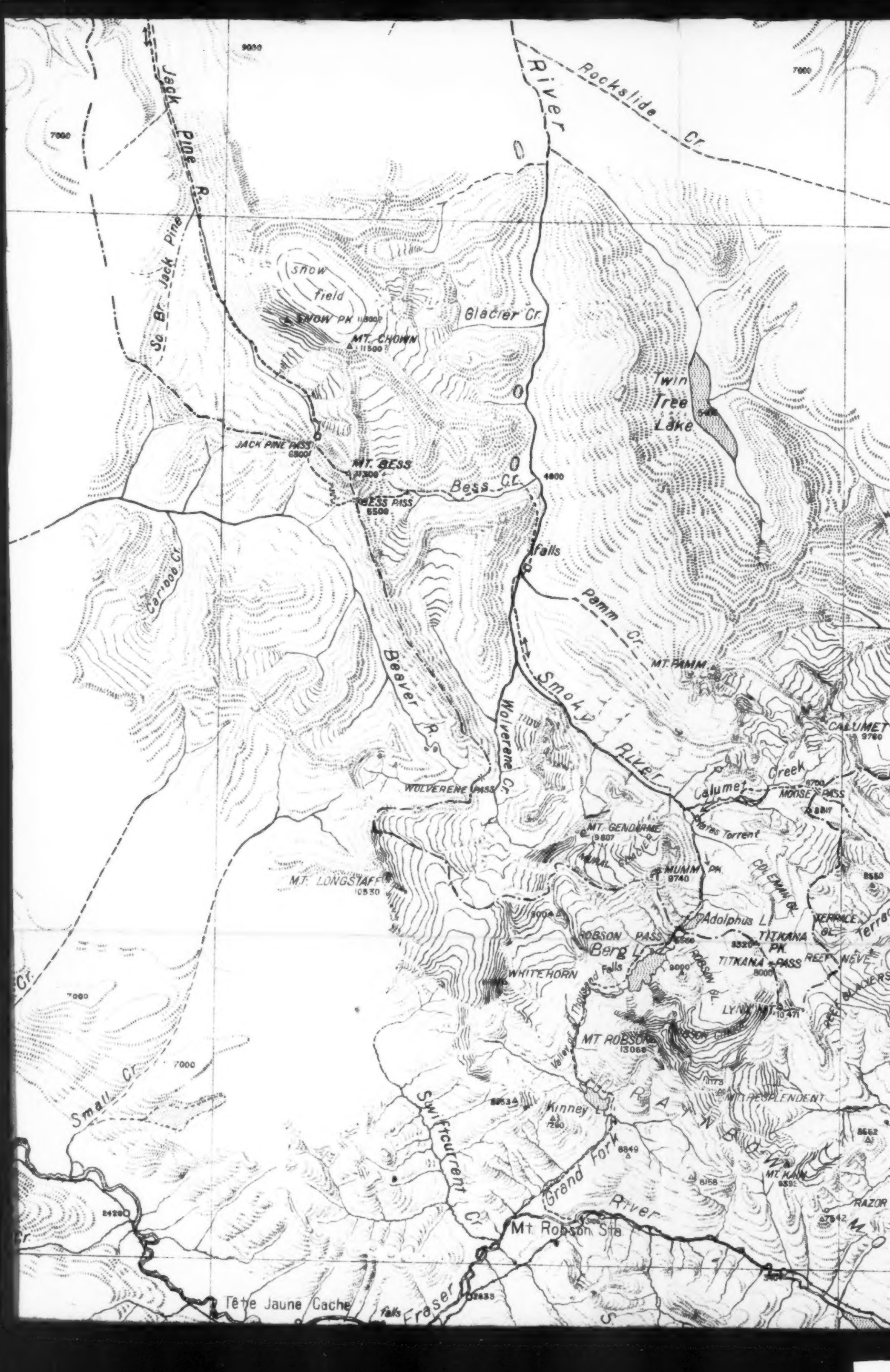
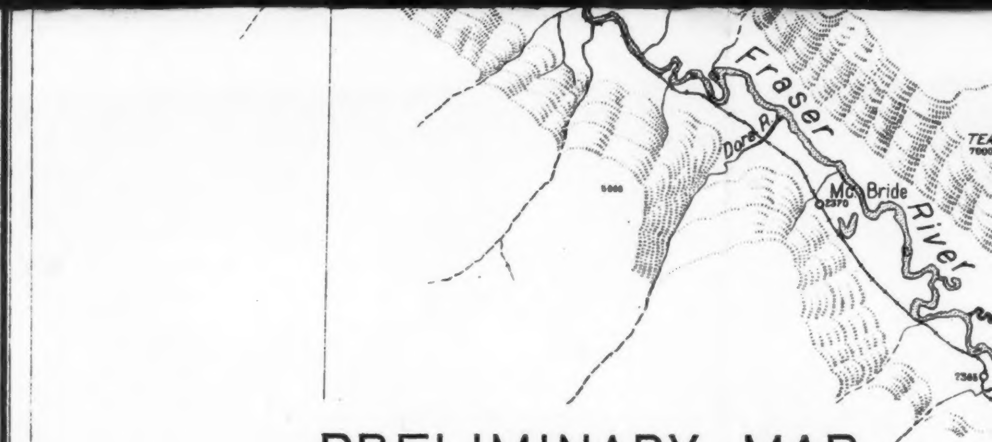


Jack Pine R.
So. Br. Jack Pine
River
Rockslide Cr.
snow field
SNOW PK 11000
MT. CHOWN 11500
Glacier Cr.
JACK PINE PASS 6800
MT. BESS 11300
Bess Cr.
BESS PASS 6500
Twin Tree Lake
falls
Pamm Cr.
Caribou Cr.
Beaver R.
Wolverene Cr.
Smoky River
MT. PAMM
CALUMET 9760
Calumet Creek
MOOSE PASS
WOLVERENE PASS
MT. GENDARME 9807
MT. LONGSTAFF 10530
MUMM PK. 9740
Adolphus L.
ROBSON PASS
Berg L.
TITKANA PK.
TITKANA PASS 8000
WHITEHORN
LYNX MT. 10471
MT ROBSON 13068
Small Cr.
Swiftcurrent Cr.
Kinney L.
Grand Fork River
MT. KAIN
RAZOR
Mt. Robson Sta.
Tête Jaune Cache
falls
Fraser
7000
9000
4800


North Branch of Stony River
Rock Lake
STONY PASS 7100
HOODOO PK.
Hoodoo Cr.
Middle Branch of Stony River
Falls
CALUMET PK.
MT UPRIGHT
SNOW MT.
South Branch of Stony River
TRIOS PK.
THE COLONEL
Colonel Cr.
Hihuna R.
Moose R.
RAZOR PK.
Terrace Cr.
NÉVÉ
GLACIERS
53°
30'
53°



PRELIMINARY MAP
OF THE
CANADIAN ROCKY MOUNTAI
BETWEEN
JARVIS PASS (54°9′N)
AND
YELLOWHEAD PASS (52°53
SHOWING

THE ROUTE FOLLOWED BY MARY L. JOBE IN AUGUST 19

COMPILED FROM AVAILABLE SOURCES, WITH CORRECTIONS AND ADDITIO
MARY L. JOBE AND DONALD PHILLIPS

Scale 1:300 000

5 4 3 2 1 0 5 10 15 Miles

53°

SOURCES
(see also note in text)

1. *Blue-print map by Grand Trunk Pacific Railway, based on reconnaissance surveys by engineers R. W. Jones, D. D. Sprague, and A. S. Going. 1:190080. 1906 (?).*

2. *Manuscript sketch map by Donald Phillips 1:200000 approx. 1914.*

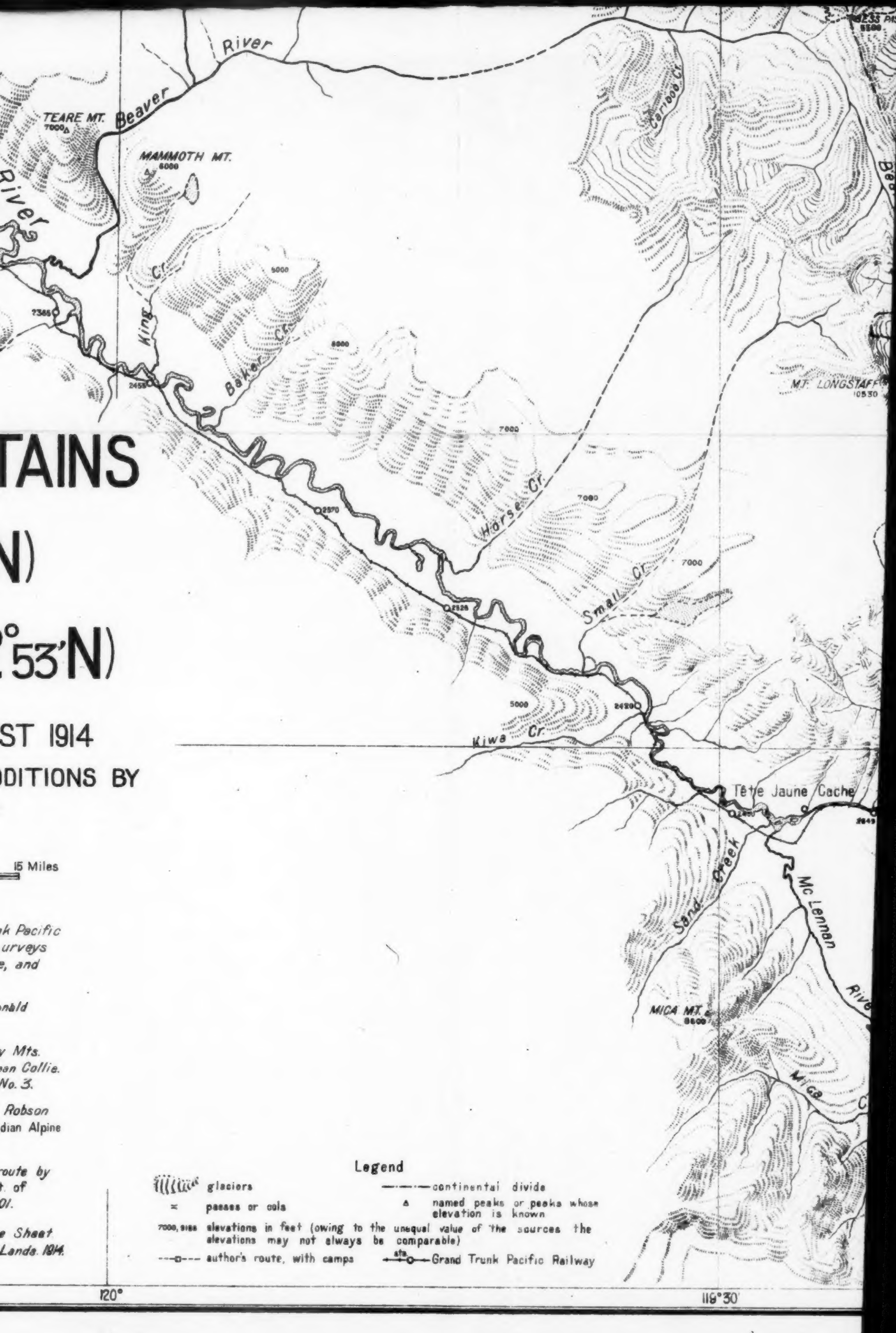
3. *Plane-table survey of Rocky Mts. north of Yellowhead Pass by J. Norman Collie. 1:500000.* Geogr. Journ., *Vol. 39, 1912, No. 3.*

4. *Photographic survey of Mt. Robson region by A. O. Wheeler. 1:100 000.* Canadian Alpine Journ. *Vol. 4, 1912*

5. *Map of the Yellowhead Pass route by James Mc Evoy. 1:506 880* Ann. Rept. of Geological Survey of Canada, *Vol. 11, 1901.*

6. *Pre-emptors Map. Tête Jaune Sheet 1:190 080 British Columbia Dept. of Lands. 191*

120°30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Sand Creek
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No. 3.
Robson
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Lands. 1914.
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glaciers
passes or cols
elevations in feet (owing to the unequal value of the sources the elevations may not always be comparable)
author's route, with camps
continental divide
named peaks or peaks whose elevation is known
Grand Trunk Pacific Railway
120°
119°30'

BESS PASS
Falls
Pamm Cr.
MT. PAMM
Smoky River
Beaver R.
Wolverene Cr.
CALUMET
Calumet Creek
MOOSE PASS
WOLVERENE PASS
Caribou Cr.
MT. GENDARME
MUMM PK.
COLEMAN GL.
MT. LONGSTAFF
Adolphus L.
TERRACE GL.
ROBSON PASS
Berg L.
TITKANA PK.
TITKANA PASS
REEF NEVE
WHITEHORN
LYNX MT.
MT. ROBSON
Kinney L.
Swiftcurrent Cr.
Small Cr.
Grand Fork
River
Mt. Robson Sta.
RAINBOW
MT. KAIN
RAZOR
Tête Jaune Cache
Fraser
SELWYN
Sand Creek
Mc Lennan River
RANGE
MICA MT.
Swift Cr.
Mica Cr.
Cranberry L.
River
Canoe
Avalanche Cr.
c Railway
119°30'
119°

THE NORRIS PETERS CO., WASHINGTON, D. C

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ing the coordinate net over the rest of the map. The resulting position of Jarvis Pass was 53°59′, and of the head of the larger lake at the head of the right source-stream of the Porcupine, 53°51′. The corresponding positions on the two most reliable maps each showing one of these features (Dawson, 10, and Northern Alberta, 11), are 54°9′[1] and 54°2′. In addition to this divergence the blue-print map showed the Sulphur River heading in the same divide as the East Branch of the Moose River, in contradiction of both Wheeler's map (4) and the map of Northern Alberta, and placed Mt. Kitchi about 30 miles from the Fraser valley, while Donald Phillips stated that it was not less than 40 miles. These and other discrepancies led the writer to believe that the contoured mountain area on the blue-print map was shown in incorrect relation to the Fraser valley, and it was accordingly pushed north to the latitude shown on the map of Northern Alberta. Subsequent correspondence with the Grand Trunk Pacific Railway brought to light another blue-print map of the same region which developed to be the original (1). On this the mountain area was shown in its northern location, with Jarvis Pass in 54°9′. The evidence now seemed conclusive that this was the correct interpretation and it was so accepted in the compilation of the map.

With the northern section of the map thus accounted for, the compilation of the remainder was relatively easy. In the southeast Wheeler's excellent photographic survey of the Mt. Robson region (4) was used and its contours interpreted by hachuring in the style of the Sectional Map of Western Canada (7), while retaining from Wheeler's map the representation of the glaciers, which are left blank on the Sectional Map. To the southwest the topography was expanded from McEvoy's contoured map (5). The Fraser River itself was taken from the Pre-emptor's map (6), while the walls of its trough valley were generalized from the contours in the original edition of the Grand Trunk map (1). The region adjoining the Wheeler survey to the north was filled in from Dr. Collie's map (3). (This map also includes the Mt. Robson region, but here it is, of course, superseded by Wheeler's map.) This left a wedge-shaped gap, 5 to 15 miles wide, between Collie's survey and the Grand Trunk Pacific survey. For this section Donald Phillips's sketch map (2) was alone available.

Not only here, but throughout the map his data have been used in correction or amplification of the other sources. For instance, on the northwestern edge of Wheeler's map Wolverene Creek is connected with the head of the Beaver; instead there should be a divide between them, as shown on the present map and also on Collie's. At Meadow Lake Pass the Grand Trunk Pacific map shows the divide to lie south of the largest lake; Phillips states it to lie north of it. On the Grand Trunk map neither the bend of the Big Salmon around the southern base of Mt. Kitchi is shown nor Providence Creek. The headwaters of the latter are there conjectured to flow into Black Bear Creek over what is actually Providence Pass: the drainage in this region has therefore been altered according to information furnished by Miss Jobe and Donald Phillips.

From what has been said it will be evident that the various sections of the map are of very unequal value. Wheeler's survey and the Fraser River are the most correct; next in accuracy come the Grand Trunk Pacific survey and McEvoy's survey, which are of reconnaissance grade; then comes Collie's survey and, finally, the section based on Phillips alone.

While all the other sections of the map are geometrical reductions of the originals, in the case of Collie's survey distortion was necessary in order to make it fit. Using the head of the Smoky River and the confluence of the Jack Pine with it as two points whose location was known (one from Wheeler's map, the other from the Grand Trunk map), the Smoky River was fitted in between these two points. This gives it a more meridional trend than in Collie's map, where its direction is north-northwest. It also gives it a change in trend at the mouth of the Wolverene which is not present on Collie's map, where the whole river from Calumet Creek to the edge of the map is rectilinear. Which version is correct remains to be seen. The prevailing northwest-southeast trend of the structural valleys in this part of the Rocky Mountains would seem to argue for

[1] While stating the latitude of Jarvis Pass to be 54°7′, the map represents it in 54°9′.

the greater correctness of Collie's map. On the other hand, the trend is incorrect on his map of several valleys in the Mt. Robson region, as indicated by Wheeler's later and more correct survey; and furthermore a difference is apparent from the map in the structure of the mountains north of the transverse courses of the Jack Pine and Smoky, where transverse and not longitudinal valleys predominate. The influence of this structural change might extend south to the upper Smoky valley. The upper valley of the Jack Pine and, consequently, the whole region between it and the Smoky have also been swung into a more meridional position. The trend of the upper Beaver having been retained, on the basis of Phillips's sketch map, as on Collie's map, this has resulted in a widening of the ridge between the upper Beaver and Jack Pine.

In the east the adjustment of Collie's survey was very satisfactory. By making the bend of the Middle Branch of the Stony River (53°15′ N. and 118°50′ W.) coincide with the same feature on the Wheeler map and drawing the remainder of the Stony drainage in its geometrical proportions, the North Branch of the Stony, taken from the Grand Trunk map, when continued to the southeast, coincided with the Deer Creek of Collie's map. The interpretation of Deer Creek as the lower North Branch seemed to be confirmed by the Grand Trunk map, on which the main Stony is shown as surveyed from its mouth to the junction of the Middle Branch, with only a small piece left conjectural between it and the North Branch. If this interpretation be correct, then Collie's North Branch (the next valley to the west, left unnamed on the present map) would simply be another longitudinal valley, presumably also leading over to the Sulphur River.

A different identification from Collie is here also given in the case of the South Branch of the Stony. By this name Collie designates the short transverse valley, here left unnamed, which forms the upper continuation of the lower Middle Branch. On Wheeler's map the head of the South Branch is shown as here reproduced. As this seems to be a major tributary, Wheeler's designation has been retained and its conjectural course shown as on the map of Northern Alberta, on which Wheeler's designation is also followed.

It has been thought wise to enter into the details of the construction of the map, inasmuch as a compilation of this nature, as contrasted with an original survey, is based on critique and not on observation, and a judgment as to its correctness can only be formed when the methods employed are known. In spite of its obvious lack of finality, the map, it is believed, constitutes a more complete representation of the region according to our present state of knowledge than heretofore available. Comparison with the latest editions of the largest-scale general maps including this region—the map of Northern Alberta (11) and the map of British Columbia (12)—will bear this out. Aside from the fact that these maps do not show relief, they have not always utilized all the sources. While reproducing Wheeler's survey the map of Northern Alberta (corrected to Sept. 1, 1914) does not utilize Collie's survey, although it was published in March, 1912. Both maps in the representation of the headwaters of the Smoky are evidently based on the Grand Trunk map—which has doubtless been filed with the Dominion railway commissioners. While the British Columbia map reproduces it *in toto,* the Northern Alberta map has modified the region near the confluence of Sheep Creek with the Smoky and the course of the Muskeg River, presumably on the basis of the surveys of the Fifteenth and the Sixteenth Base Lines (8 and 9). While the survey of the base lines themselves is probably satisfactory, the topography on each side does not claim to be,[2] and it would seem wiser to retain the railroad survey, which is at least consistent within itself. With regard to the upper courses of the Smoky, Jack Pine and main Beaver these two maps are either conjectural or are left blank. But their course determines the continental divide and, consequently, the boundary between Alberta and British Columbia, which follows the divide from the United States boundary to the 120th meridian. The present map is therefore able to offer some additional information on this question of practical interest.

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[2] On map 8 the Smoky crosses the line between townships 58 and 59 in range 7, on map 9 it crosses the same line in the corresponding part of range 6. This has led to its being stretched on the map of Northern Alberta.

In conclusion it is a pleasure to acknowledge the Society's indebtedness to the Grand Trunk Pacific Railway for the permission to reproduce its blue-print map and particularly to its Assistant Chief Engineer, Mr. A. A. Woods, for his unfailing courtesy in answering inquiries. Dr. E. Deville, the Surveyor General of Canada, was also good enough to answer several inquiries as to the reliability of various government maps. During compilation, Miss Jobe and Mr. Phillips kindly checked up the map from notes and photographs and offered helpful suggestions.

Any information tending to the correction or expansion of the map will be gratefully received by the Society. W. L. G. J.

List of Maps Used.

1. [Blue-print map by Grand Trunk Pacific Railway]. 1:190,080. In two latitudinal strips covering 56°12′ - 52°45′ N. and 123°15′ - 117° W. 1906?.
 [Original. Correct location of mountain region. Shows geographic coordinates and township squares. Relief in contours. Routes of engineers' reconnaissance surveys shown (R. W. Jones, D. D. Sprague, A. S. Going), affording criterion as to reliability of various sections. Fraser valley in reconnaissance.]

1a. [Blue-print map by Grand Trunk Pacific Railway]. 1:190,080. Section covering 54°20′-52°45′ N. and 123°15′ - 118°30′ W. 1914?.
 [Copy from above. Incorrect location of mountain region. No geographic coordinates or township squares. Fraser valley from land surveys.]

2. [Manuscript sketch map by Mary L. Jobe and Donald Phillips]. 1:200,000 approx. 54°10′ - 52°45′ N.; 122°0′ - 118°25′ W. 1915.

3. Part of the Rocky Mountains north of the Yellowhead Pass, from a plane table survey by Professor J. Norman Collie, F.R.S., 1910-11. 1:500,000. 53°35′ - 52°35′ N.; 120°0′ - 117°30′ W. Accompanies "Exploration in the Rocky Mountains North of the Yellowhead Pass" by J. Norman Collie, *Geogr. Journ.*, Vol. 39, 1912, No. 3, pp. 223-235.
 [Relief in shading.]

4. Topographical Map Showing Mount Robson and Mountains of the Continental Divide North Yellowhead Pass. From photographic surveys by Arthur O. Wheeler. [1:100,000]. [53°17′ - 52°45′ N.; 119°27′ - 118°20′ W.] Accompanies "The Alpine Club of Canada's Expedition to Jasper Park, Yellowhead Pass and Mount Robson Region, 1911," by A. O. Wheeler, *Canadian Alpine Journ.*, Vol. 4, 1912, pp. 1-83; also "Special Number" of *Canadian Alpine Journ.*, 1912; also "The Mountains of the Yellowhead Pass" by A. O. Wheeler, *Alpine Journ.*, Vol. 26, 1912, pp. 382-407; also *Annual Report Topogr. Surv. Branch for 1911-12*, Ottawa, 1913.
 [Relief in contours.]

5. Map showing Yellowhead Pass Route from Edmonton to Tête-Jaune Cache. 1:506,880. 53°45′ - 52°38′ N.; 119°34′ - 113°18′ W. Accompanies "Report on the Geology and Natural Resources of the Country Traversed by the Yellowhead Pass Route from Edmonton to Tête Jaune Cache" by James McEvoy, Sub-report D (44 pp., 1900), *Annual Report, Geol. Survey of Canada, for 1898*, N. S., Vol. 11, 1901.
 [Relief in contours.]

6. Pre-emptor's Map [of British Columbia]: Tête Jaune Sheet (No. 3 H). 1:190,080. 53°48′-52°41′ N.; 121°10′ - 118°22′ W. Dept. of Lands, British Columbia. Revised to April 3, 1914.
 [No relief.]

7. Sectional Map [of Western Canada]: Yellowhead Sheet. 1:190,080. 53°12′ - 52°28′ N.; 120°0′-118°0′. Topographical Surveys Branch, Dept. of the Interior, Ottawa. Revised to Oct. 10, 1912.
 [Relief of Wheeler's survey in hachuring.]

8. Sketch Map Showing Topography of the Fifteenth Base Line across Ranges 25, 26 and 27, West of 5th Meridian, and Ranges 1 to 8, West of 6th Meridian, Province of Alberta. 1:380,160. [54°4′ - 53°43′ N.; 119°14′ - 117°33′ W.]. Accompanies "Extracts from the Report of A. H. Hawkins, D.L.S.", Appendix No. 21, *Annual Report Topogr. Surveys Branch for 1909-1910*, pp. 84-91, Ottawa, 1911.
 [Generalized relief.]

9. Sketch Map of the Sixteenth Base Line across Ranges 5 to 13 and the Seventeenth Base Line across Ranges 9 to 14, West of the 6th Meridian. 1:380,160. [54°-45′ - 54°4′ N.; 120°7′ - 118°36′]. Accompanies, in pocket of report for 1911-12, "Abstract of the Report of George McMillan, D.L.S.", Appendix No. 35, *Annual Report Topogr. Surveys Branch for 1910-1911*, pp. 116-118, Ottawa, 1912.
 [No relief.]

10. Map of Part of British Columbia and the Northwest Territory from the Pacific Ocean to Fort Edmonton. Sheet II. 1:506,880. 57°8′ - 53°49′ N.; 124°35′ - 117°55′ W. Accompanies "Report of an Exploration from Port Simpson on the Pacific Coast to Edmonton on the Saskatchewan, Embracing a Portion of the Northern Part of British Columbia and the Peace River Country, 1879," by George M. Dawson, Sub-report B (165 pp., 1881), *Report of Progress, Geol. Survey of Canada, for 1879-80*, Montreal, 1881.

11. Northern Alberta: Map Showing Disposition of Lands. Prepared under the direction of F. C. C. Lynch, Superintendent of Railway Lands, [by] J. E. Chalifour, Chief Geographer. 1:792,000. 60°15′ - 52°50′ N.; 120°20′ - 109°15′ W. Dept. of the Interior, Ottawa. Eighth edition, corrected to Sept. 1, 1914.

12. British Columbia. [Compiled under the direction of] G. G. Aitken, Chief Geographer. 1:1,125,000. 61° - 48° N.; 140° - 112½° W. British Columbia Dept. of Lands, Victoria, B. C., 1912.

THE NEW YORK STATE BARGE CANAL*

By WILFRED H. SCHOFF
Secretary, The Commercial Museum, Philadelphia

The object of the barge canal system is to provide navigation connecting New York Harbor at tide level with Lake Champlain 96.5 feet above sea-level, Lake Ontario 244.4 feet and with Lake Erie 573 feet. Connection between the ocean and the canal proper is made by the Hudson River, which is, geologically speaking, a drowned valley or tidal estuary as far as Hudson, the delta formations of the river being found between Hudson and the natural falls near Troy, long ago submerged by the State dam at that city.

The Federal Government is now at work on a channel improvement project on the upper Hudson, designed to provide a uniform depth of 12 feet between Hudson and the Troy dam. At Troy this project includes the construction of a great concrete dam spanning the river at Troy, with a single lock at the eastern bank of 15 feet lift. The lock dimensions are 492 feet long, 45 feet wide and 14 feet deep. Into the pool created by the Troy dam, which provides 12 feet depth as far as Waterford, the northern terminus of the Federal project, both the Champlain and the Erie Canals will discharge their traffic. The Champlain branch will connect the Troy dam with the Narrows of Lake Champlain at Whitehall. The length of this waterway is 61.5 miles, and the plan provides for abandonment of a large part of the old Champlain Canal and for canalization of the Hudson River by utilizing existing dams. This branch has eleven locks. It ascends from the Waterford pool to a summit level between Fort Edward and Fort Ann 125 feet above the pool, or 140 feet above tide water. Thence it descends 43.5 feet to the Lake Champlain level.

This lake, being an interstate waterway, is also under the jurisdiction of the Federal Government, and before a uniform 12 foot depth can be had between the barge canal and Canadian waters, further improvement of the Champlain Narrows will be necessary. This work is partly provided for under existing Federal legislation, and it is anticipated that more active work will be undertaken whenever the political controversy over River and Harbor bills shall have been adjusted.

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*Continued from pp. 321-333, May *Bulletin*.

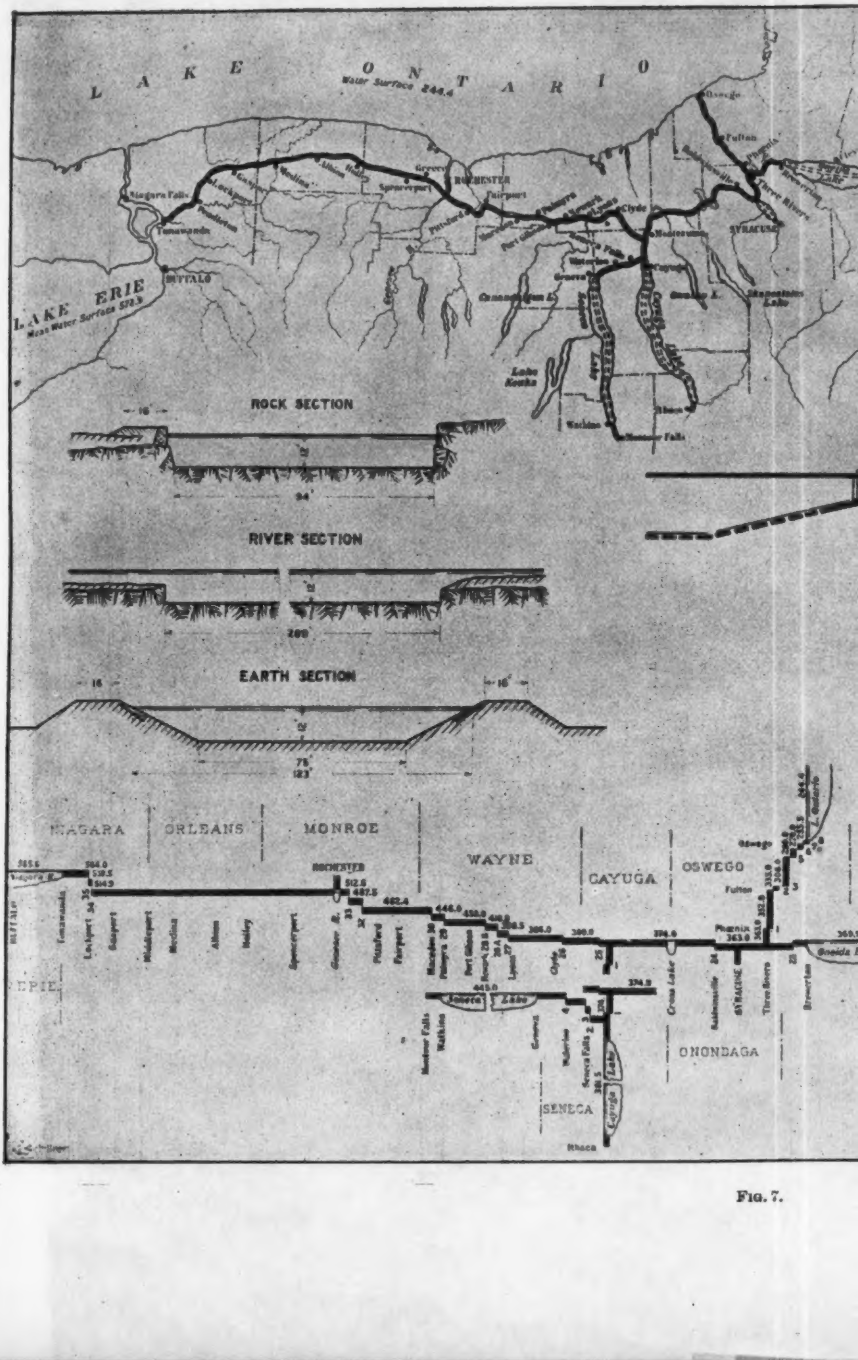
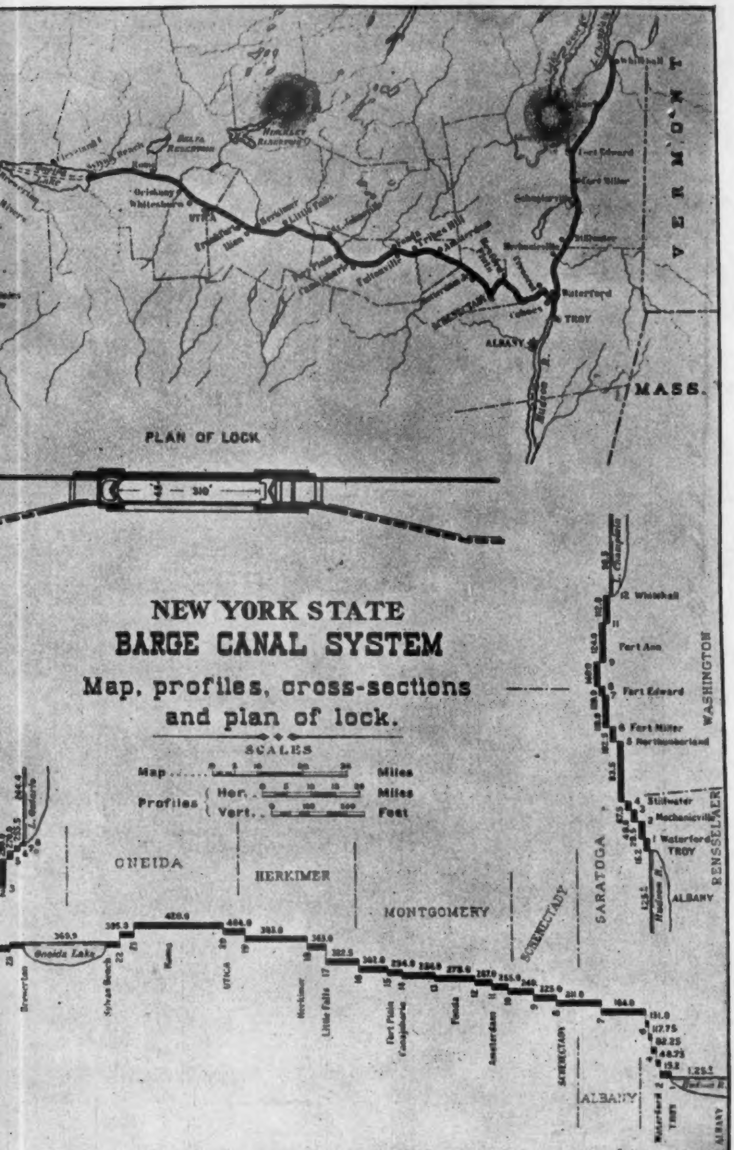

LAKE ONTARIO
Water Surface 246.4
LAKE ERIE
Mean Water Surface 572.5
ROCHESTER
BUFFALO
SYRACUSE
Oswego
Fulton
Clyde
Tonawanda
Niagara Falls
ROCK SECTION
94'
RIVER SECTION
200'
EARTH SECTION
16'
75'
123'
NIAGARA
ORLEANS
MONROE
WAYNE
CAYUGA
OSWEGO
ONONDAGA
SENECA
Seneca Lake
Cayuga Lake
Cross Lake
Oneida Lake
Ithaca
Watkins
Phoenix
Three Rivers
Brewerton
Lockport
Gasport
Middleport
Medina
Albion
Holley
Spencerport
Pittsford
Fairport
Macedon
Palmyra
Port Gibson
Newark
Lyons
Geneva
Waterloo
Seneca Falls
Baldwinsville

Fig. 7.


PLAN OF LOCK
NEW YORK STATE
BARGE CANAL SYSTEM
Map, profiles, cross-sections
and plan of lock.
SCALES
Map Miles
Profiles Hor. Miles
Vert. Feet
VERMONT
MASS.
Whitehall
Fort Edward
Waterford
TROY
ALBANY
UTICA
Little Falls
ONEIDA
HERKIMER
MONTGOMERY
SCHENECTADY
SARATOGA
WASHINGTON
RENSSELAER
ALBANY
Fort Ann
Fort Miller
Northumberland
Stillwater
Mechanicville
Oneida Lake
Herkimer
Fonda
Amsterdam

PROFILE OF BARGE CANAL

FIG. 8.

The Erie branch or main line of the barge canal likewise begins at the Waterford pool, from which it ascends by a magnificent series of five great concrete locks and pools to the level of the Mohawk River, above Cohoes Falls, the river being backed up at that point by the Crescent dam at a level of 184 feet, or 169 feet above Waterford. From this point the barge canal steadily ascends the Mohawk River, which is canalized by a series of movable dams, reaching a summit at Rome of 420 feet. This level is nearly twenty miles in length and receives its water-supply from two great dams, one at Delta near Rome, the other at Hinckley a few miles further away, the two combining to impound the greater part of the watershed of the southern Adirondacks. From Rome the old Black River branch canal leads from the barge canal system to Lake Ontario at Watertown, retaining, however, the former limited dimensions as the service of the canal is for moderate local traffic. From the Rome summit level the canal descends to Oneida Lake at an altitude of 369.9 feet and thence to Three Rivers at a level of 363 feet, which is the low point of the central canal section. From this Three Rivers level the Oswego canal branches northward connecting with Lake Ontario at Oswego at an elevation of 244.5 feet. The Oswego canal is of standard barge canal dimensions. From this level also connection is made by a spur leading to the city of Syracuse.

One of the great problems of the barge canal reconstruction, it may be noted, was that of enlarging the canal where it passed through built-up communities, and in the case of both Syracuse and Rochester it was found preferable, owing to excessive damages incident to canal enlargement, to carry the new barge canal well outside those cities and to provide each with a spur.

Westward of the Syracuse level the canal rises to Cross Lake, 374 feet, from which a branch system, provided for by an act adopted in 1909, connects the barge canal with Cayuga and Seneca Lakes. Cayuga Lake is at a level of 381.5 feet, the southern or upper terminus being Ithaca. The Seneca Lake level is 445 feet, the terminus being at Montour Falls, this branch making considerable ascent at Seneca Falls, one of the earliest industrial communities of central New York owing to the water power there developed.

The main line of the barge canal between the Seneca and Niagara Rivers, with the exception of the Rochester cut-off, is merely an enlargement of the old Erie Canal prism. It rises from the Cross Lake level of 374 feet to the Rochester level of 514.9 feet at which the canal maintains a continuous level for more than fifty miles to Lockport, where it meets and ascends the Niagara escarpment and joins the Niagara River at Tonawanda at an elevation of 565 feet. This river being within the jurisdiction of the Federal Government, access to the harbor of Buffalo is had by the so-called Black Rock ship canal, consisting of a great concrete lock and an artificial channel by which the rapids of the Niagara River are avoided and vessels raised from the Tonawanda to the Lake Erie level. The dimensions of the lock are 650 feet long, 70 feet wide and 24 feet deep.

This outline of the barge canal shows, then, that about two-thirds of the new waterway will be new construction and one-third enlargement of the old Erie Canal.

Owing to the length of the route, there are almost innumerable points of engineering interest, of which only a few of the more notable may be here indicated. The Champlain Canal, being mainly a canalization of the Hudson River of shallow section and flowing over rock strata, required much rock excavation. Various methods were employed for this work, including dry excavation within cofferdams, drill boats and under-water blasting, and excavation with dipper drills and rock breakers by which hammers weighing some sixteen tons were so arranged as to be dropped from considerable heights, thus breaking up the rock at the bottom of the channel for removal by dredges.

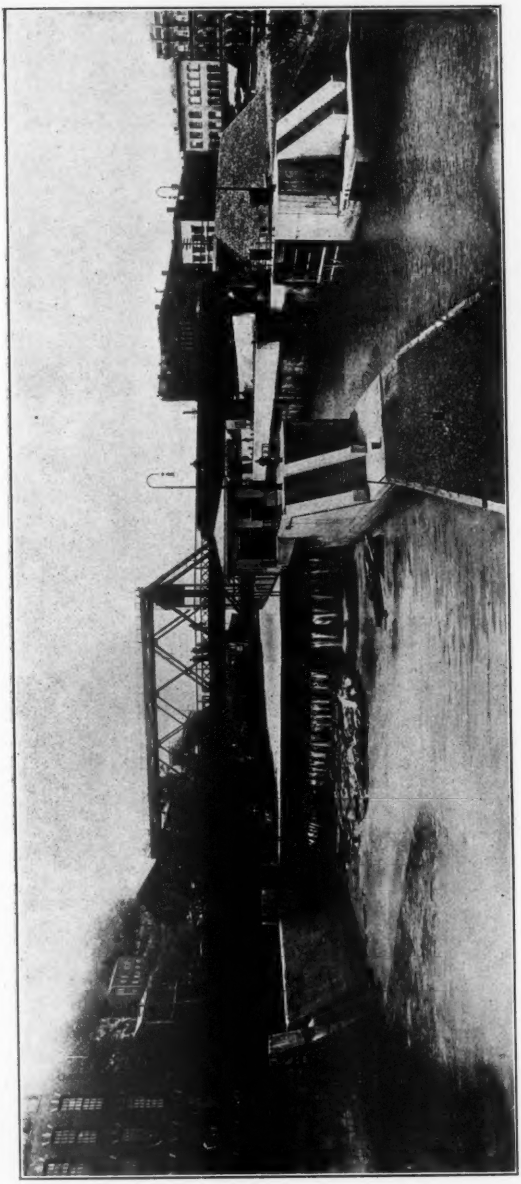


Fig. 9—Barge Canal Terminus, Whitehall, N. Y. Connecting with Lake Champlain. Showing lock and siphon spillway.

An interesting structure on the Champlain Canal is the siphon spillway, originated by the New York engineers. It is designed especially for use in contracted locations where the ordinary long overfall spillway is not feasible. It is operated automatically, both starting and stopping. The summit level of the Champlain Canal is supplied by a feeder from the upper Hudson, and the waterway enters Lake Champlain at Whitehall through a striking combination of structures, including a siphon spillway, a central dam with movable crest, which is operated from a highway bridge spanning the entire structure, and regulates the level of Wood Creek, adjacent to which is lock No. 12 of the canal with its power-house and electric equipment. A bird's-eye view of the canal as it approaches Whitehall is extremely impressive. The completed barge canal makes its way through the valley of Wood Creek in two long reaches, with a single bend, while the creek itself and the old Champlain Canal go wandering around through the valley, crossing and re-crossing the new waterway at several points.

It is, however, on the section of the Barge Canal between Waterford and Oswego that the most impressive work of the entire system is perhaps to be found. The Mohawk River falls over the rock ledge at Cohoes nearly 170 feet before joining the Hudson River. This waterfall—the largest in volume within the state of New York, and one of the most impressive in the country—provides power for the great textile mills and other industries in the vicinity. The old Erie Canal reached Albany by a ditch and numerous locks following the southern bank of the river. The new waterway makes the ascent by following a natural depression that served perhaps in other geological times as the channel of the river, leaving the Hudson north of Cohoes and ascending the valley by the flight of five successive locks to the Crescent dam, already described. One of the features of the canal construction is the safety gate at the Crescent dam level, by which it is made impossible for the flow of the Mohawk River to be diverted in time of flood, or by reason of accident, through the barge canal locks. If such an accident were to happen, it would result in the flooding and probable destruction of the town of Waterford.

The Crescent dam itself, by which the slack-water navigation of the Mohawk River begins, is a great concrete structure having a length of nearly 2,000 feet and a crest thirty-nine feet above the apron. Most of the locks on the barge canal system have individual power-houses for generating power for operating and lighting the

lock, each house being equipped with two power units in order that one may be always available. Hand operating devices are also supplied for all machinery in event of accident disabling both power units. These plants are not operated all the time, but only as traffic requires. Water is turned into the turbines when it becomes necessary to operate the lock, and after fifty seconds the power is on ready for operation at full speed.

The next great dam across the Mohawk River is at Vischer's Ferry, this structure also being about 2,000 feet long, the barge canal lock being on the right or southern bank. This dam is not a continuous structure, as the river is separated here into two natural channels by a rocky island, which forms the central section of the

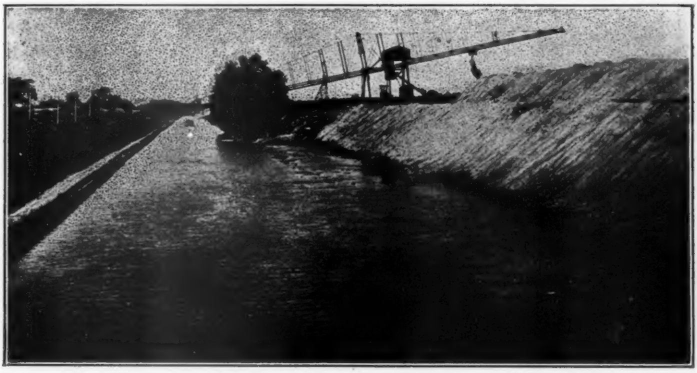


FIG. 10—Enlargement of Erie Canal: section dredge and conveyor.

dam. Between Schenectady and Little Falls the Mohawk River has been canalized by building eight movable bridge dams of a novel type. These dams maintain pools at the required level during the navigation season, and during the winter the entire structure is elevated and the river flows through its natural channel unimpeded. This prevents destruction of property along the banks, which would be especially severe with the breaking up of the ice at the end of winter. The Boulé gates are raised by means of chains operated by electric winches running on tracks on the bridge floor. These Mohawk dams have either two or three spans, the total lengths ranging from 370 to 590 feet, and the depth of water between sill and upper level varying between 16 and 20 feet.

At Little Falls, always a point of difficulty in canal construction,

owing to the narrow defile through which the stream passes and the great hardness of the rock, the barge canal makes the ascent by a single concrete lift lock of extreme elevation (40.5 feet lift), the lower gate of this structure being also of the lift type.

A short distance beyond, at Herkimer, is another movable dam of notable construction, being of the Poirée type. The depth of the pool is regulated by ingenious mechanism.

Under ordinary conditions of rainfall the eastern summit level of the canal, of which Utica and Rome are the focal points, would have an entirely insufficient water-supply, and in order to provide for operation of the canal, two great dams have been constructed, as already explained, to impound the southern Adirondack watershed. The eastern or Hinckley dam is an earth structure 3,700 feet long rising fifty-six feet above the natural surface and creating a reservoir area of 4½ square miles, which drains a watershed of 372 square miles and provides a storage capacity of 3,500,000,000 cubic feet. The Delta dam is a structure of singular beauty, being of masonry connecting sharply rising banks and of unusual height, while a feature of the work is the concrete aqueduct just below the dam by which the Black River canal is carried across the Delta spillway, ascending the farther bank by a flight of three locks adjacent to the dam. This Delta dam is 1,100 feet long, 100 feet high above rock and creates a reservoir of 4⅓ square miles, draining a watershed of 137 square miles and providing storage capacity of 2,750,000,000 cubic feet.

From the Rome summit level the canal descends by two locks to Oneida Lake, left aside by the old Erie Canal, but utilized through its entire length by the barge canal. A few miles west of Oneida Lake, at Three Rivers, the Oswego Canal leaves the main line and descends by eight locks to Lake Ontario. At the northern end of this Oswego branch where it enters the Lake a siphon lock of peculiar design has been built, the only lock of the kind in America and the largest to which that principle has ever been applied. This section of the barge system between Oswego and the Hudson River at Waterford will be the first opened to traffic according to the present plans, and will thus open modern barge communication with Lake Ontario in advance of that with Lake Erie.

In the western section of the canal, the alignment being almost the same as that of the old Erie Canal, the work of improvement has consisted merely in widening and deepening the old channel and providing necessary new walls and structures. The worst diffi-

culties have arisen from leaks and breaks. Near Rochester, for instance, the valley of Irondequoit Creek was filled by embankments and the canal carried over it in a concrete trough. A serious break in this trough forced additional precautions and the lining of adjacent sections of the canal entirely with concrete. Near Rochester also occurs one of the deepest rock cuts along the entire work, while at Medina, about half way between Rochester and Lake Erie, a very interesting construction carries the canal across Old Oak Orchard Creek. Here the Creek flows through a deep gorge which it was originally intended to cross by a long span concrete arch, but finally the old canal route circling the gorge was preferred

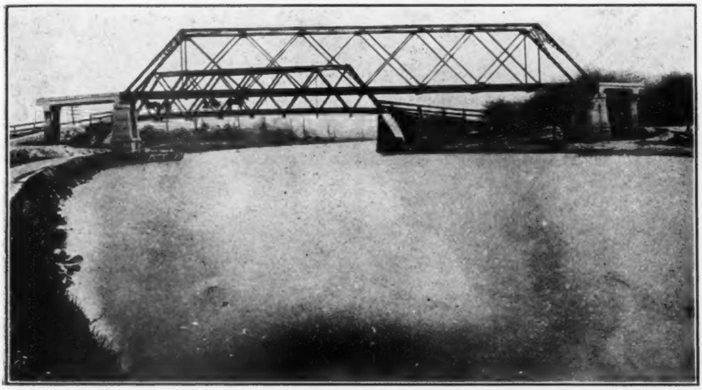


Fig. 11—Section of canal showing enlargement of prism and new standard bridge as compared with old Erie Canal bridge.

and this required the construction of a high retaining wall, so that the barge canal runs for about one-third of a mile behind a dam forty-five feet high. At Lockport the canal rises from the Ontario to the Erie level ascending the Niagara escarpment. Here the old Erie Canal made the ascent of forty-nine feet by a double flight of five locks each, or ten altogether, which, when first built, were one of the wonders of the country, and although long ago outgrown, were always a noteworthy example of lock construction. Here the State engineers have retained for local use one of the parallel flights of five locks, while the other flight has been entirely torn away, the under-lying rock blasted out and the ascent made by building two barge canal locks of standard dimensions. While the symmetry of the old double flight is thus quite ruined, the presence

of both the old and the new locks side by side forms a permanent object lesson of the vast growth in American commerce during a single century of national development, and small boats will be enabled to pass through the locks without calling for the use of the great amount of water needed to operate the standard barge canal locks.

The ridge above Lockport is composed of rock and the excavation of a channel through this rock was a very interesting piece of work, being carried on with a battery of channelers and a double boom conveyor working in conjunction with a steam shovel. It was on

Fig. 12—Locks at Lockport, N. Y. Erie Canal locks at right, Barge Canal locks at left.

this westernmost section of the canal that the heaviest work was necessary.

The terminus of the new barge canal is at its junction with the Niagara River at Tonawanda, except that the old Erie Canal in Buffalo is retained for local harbor and canal purposes. The passage of the rapids in the Niagara River between Tonawanda and Buffalo is effected by the Federal Black Rock Harbor and Channel, which was completed and opened to traffic at the end of 1914. This is really a canal built along the east bank of Niagara River, but separated from the main stream by a pier and island. The original channel was built as a terminal for the Erie Canal, being four miles long and 200 to 400 feet wide. The present improvement provides a deep draft channel 200 feet wide and 23 feet deep, joining at

Buffalo the 23-foot channel there completed in 1908. After passing through the great concrete ship lock which overcomes the rapids in the river, the channel extends about two and a half miles, 400 feet wide, to deep water above Tonawanda, at a total cost of about $4,500,000. The work of constructing this Black Rock ship lock was done inside a great coffer-dam made of interlocking sheet steel piling, and owing to the very large dimensions of the coffer-dam, and the great resistance which it overcame, this was regarded by engineers as the most important sheet piling structure ever built.

The dimensions of the Black Rock ship lock are 650 ft. long, 70 ft. wide and 24 ft. deep.

Barge Canal traffic reaching Buffalo is, of course, protected from Lake Erie by the Government harbor structures. The original port at Buffalo was the narrow winding Buffalo Creek. The entrance from the Lake was shallow and frequently closed by bars. In later years the harbor works were greatly extended. The inner river and canal and basin harbor is now about seven miles long and 200 feet wide, project depth being 23 feet. At the southern end of this outer harbor great steel works have been built, which utilize the Lake Superior ore at the eastern limit of Great Lakes navigation.

The plans for the barge canal have proceeded on an estimated seasonal traffic of 10,000,000 tons, but providing capacity for handling a maximum traffic of 18,500,000 to 20,000,000 tons per season.

Barge Canal Statistics

The entire barge canal undertaking is summarized in the following statistics:

Erie branch, length of canal, not including Hudson and Niagara river termini	323.4 miles
Erie branch, number of locks	35
Oneida Lake, not included in above mileage, no improvement needed	about 19 miles
Spurs to Erie branch (Rochester and Syracuse harbors, including Onondaga lake)	9.1 miles
Champlain branch, length of canal	61.5 miles
Champlain branch, number of locks	11
Oswego branch, length of canal	22.8 miles
Oswego branch, number of locks	7
Cayuga and Seneca branch, length of canal (including spurs at heads of lakes)	27.5 miles
Cayuga and Seneca branch, number of locks	4
Cayuga and Seneca lakes, portions needing no improvement and not included in above mileage	65 miles

Width of channel, land line, earth section, bottom, minimum	75	feet
Width of channel, land line, earth section, water-surface	123 to 171	feet
Width of channel, land line, rock section, bottom, minimum	94	feet
Width of channel, river line, bottom, generally	200	feet
Depth of channel, land line and minimum river line	12	feet
Locks, length between gates	338 to 343	feet
Locks, length of chamber—available length	311	feet
Locks, width of chamber	45	feet
Locks, depth of water on sills	12	feet
Dams, new	30	
Dams, old, with new crests	5	
Dams, old, used without change	5	
Bridges	199	
Boats, capacity, using full lock width	about 3000	tons
Boats, capacity, built for two to pass in most restricted channel and for two, traveling tandem, to be locked at one lockage	about 1500	tons
Authorization of work (Erie, Champlain and Oswego canals)	Chapter 147, Laws of 1903	
Authorization of work (Cayuga and Seneca canal)	Chapter 391, Laws of 1909	
Appropriation (Erie, Champlain and Oswego canals)	$101,000,000	
Appropriation (Cayuga and Seneca canal)	$7,000,000	
Construction work begun (Champlain canal)	April 24, 1905	
Construction work begun (Erie canal)	June 7, 1905	
Excavation, preliminary (1903) estimate, not including work for dams, bridges, highways, railway, and steam changes and other small items (Erie, Champlain and Oswego canals)	132,225,800	cu. yds.
Excavation, contract plans (Erie, Champlain and Oswego canals), approximate	105,239,000	cu. yds.
Excavation, contract plans (Cayuga and Seneca canal), approximate	10,592,000	cu. yds.
Concrete, preliminary (1903) estimate (Erie, Champlain and Oswego canals)	3,243,100	cu. yds.
Concrete, contract plans (Erie, Champlain and Oswego canals), approximate	2,698,000	cu. yds.
Concrete, contract plans (Cayuga and Seneca canal), approximate	196,000	cu. yds.†

† In the concluding part of this paper the author will discuss the canal traffic, past, present and prospective.

(To be concluded)

NOTES ON THE SIGNIFICANCE OF THE BIOTA AND OF BIOGEOGRAPHY[1]

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Introduction; Requirements of Species; The Biota, A Response to Geographic Conditions; Influences of the Biota; Biogeography and Human Geography.

I. Introduction

Although the native flora and fauna represent but a small portion of the life which in any area ultimately may be put to the use of civilized man, and many include a few species of conspicuous economic significance, their study is well worth while for several reasons. (1) It makes practicable a comparison even of widely separated areas in respect to climate, ground-water and soil. (2) It greatly extends our knowledge of geographic conditions, making possible, for example, an intelligent selection of useful varieties of plants and animals which may be introduced with probable success. (3) The flora in many cases is an indication of the agricultural possibilities of an area. (4) Vegetation and animals affect run-off, erosion, and soil. (5) The native biota has vastly influenced human activities, and its study therefore is a prerequisite to a full understanding of the human geography of any region. These points will be taken up after a brief discussion of some requirements of species and some differences between the original and possible future biotas.

II. Requirements of Species

Each species has many and in most cases complex requirements, such as proper amounts of (1) moisture, including water vapor as well as liquid water; (2) heat, including requisite periods when the temperatures are above definite minima—for example, 32°; (3) light, including sunshine; (4) food, inorganic as well as organic; (5) appropriate anchorage for sessile forms; (6) proper sites in which to rear their young; (7) not too powerful rivals or enemies; (8) effective means of dissemination. Moreover, various plants are fertilized by but few, and some of them by highly specialized insects.

1 Professors R. D. Salisbury, J. Paul Goode, Henry C. Cowles, and Victor E. Shelford made valuable suggestions during the preparation of this paper, for which assistance acknowledgment is hereby gratefully made.

The range of such plants cannot extend much beyond that of such insects unless they are propagated vegetatively.

An environment may be favorable in almost all respects to various species which are not found there, but if only one of the numerous requirements is unfulfilled that species is barred. In a region where the climate is highly variable, an area perhaps may be favorable for a given species during most years, but the exceptional drought or the occasional unseasonable frost may keep the species out. Species which possess means of prompt reintroduction may be re-established soon after local extermination. The great significance of means of dispersal is indicated by the fact that the terrestrial species which are most widely distributed are those which are distributed through the air by the winds, as willows, birches, poplars, bacteria, diatoms and fungi, or those that are able to fly, as most insects, birds, and bats; while the next most widespread are those disseminated through the agency of civilized man. Deficiency in means of dispersal tends to retard greatly the spread and to restrict the ranges of many interdependent groups, as examples of which are tree-squirrels and nut-bearing trees, fruit-eating birds and bats and certain trees and shrubs. Herbs whose seeds are armed with hooks depend largely upon wide-ranging mammals for their spread. Numerous animals are carried by others while in egg, larval, or adult stages. Examples are certain molluscs which attach themselves to the gills of fish, and all parasites, many of which cause sickness and produce "diseases."

There are numerous illustrations of the success of species which have crossed the barrier of sea, mountain or other unfavorable tract and have become established in other areas: the English sparrow, Norwegian rat, house mouse, and, in Australia, the rabbit, among the vertebrates; the house fly, tent caterpillar, bedbug, potato beetle, and many other insect pests; the Russian thistle, sweet-clover, and pigweed in America among the plants, and many others elsewhere, for instance, the braken fern and aguave in Australasia, and the cactus in the Mediterranean region.

Many additional species may prosper if conditions are improved but slightly in one or more particulars. Thus slight improvement in (1) planting, (2) cultivation, (3) supplying water at critical times and places, might enable some species not now represented to establish themselves. Wells have increased in many respects the utility of areas naturally deficient in drinking water. The marvelous results of irrigation are well known. (4) The virtual lengthening of the season by affording protection in the early stages of

growth by means of hotbeds for various vegetables. (5) Protection from enemies. The animals of prey have been nearly exterminated over large areas. (6) The elimination of competitors. The bison, antelope, and mustangs were rivals of cattle, sheep and horses, and were of necessity nearly exterminated before the latter became common. Without the breaking up of the sod and the consequent destruction of the native vegetation of the area affected, the raising of nearly all crops would be impossible in many regions.

For these reasons and perhaps others the flora and fauna which will occupy most areas when they finally are put to maximum use by highly civilized man will be far more abundant, profitable, and diverse than those which originally prevailed, and probably richer in species, although many native species will be exterminated over large areas. This enrichment will take place along at least the following lines: (1) Similar regions the world over will yield species which will be introduced and put to the use of man. (2) Some of the plants, now useless, doubtless will become useful with the advance of civilization. Two decades ago, for example, it was not anticipated that the guayule shrub would give to desert lands where it grows a value of as much as $20 per acre, which it now does because it became profitable to extract the rubber which it was found to contain. (3) The improvement of native stocks by hybridization and selection has accomplished much and has great possibilities. (4) The acclimatization of certain forms not at first successfully raised is practicable[2]. (5) A thorough adjustment of the biota to the geographic conditions, especially climate and soil, would enormously increase the productivity of the area. (6) Improved methods of transportation and preservation and increased local markets may make it profitable to put all portions of the area to more effective use. (7) Drainage or irrigation of areas susceptible thereto very greatly increases their productivity. (8) The addition of various substances to the soil often enables it to support a richer biota.

Because large areas were primitively, or still are very uninviting does not prove that they will not support a large population in the future. Most irrigated areas were exceedingly unattractive until they were irrigated, when they became worth more than $100 per acre in most regions. Areas, miles in extent, which in the range days could not permanently support a single steer because of the occasional lack of drinking water and winter food can now, with

[2] For an excellent discussion of these four methods see Hedrick, U. P.: "Multiplicity of Crops as a Means of Increasing the Future Food Supply," *Science*, Oct. 30, 1914, pp. 611–620.

the help of wells, a small amount of hay, and shelter, support scores per square mile. Great confidence is expressed by those best entitled to an opinion that within a decade or two much of the sod of millions of acres of the semi-arid regions will be sprinkled with luxuriant plants of certain Siberian and hybrid strains of alfalfa, and thus the productivity of certain lands increased from nearly nil to exceed that of the present best grazing lands of the region.

Although the original biota thus differs widely from the biota likely to prevail under conditions of high civilization and dense population, its study is distinctly valuable as a preliminary step in the determination of the geographic conditions of the area.

III. The Biota as a Response to Geographic Conditions Extends Our Knowledge of These Conditions.

Biogeography extends our knowledge of geographic conditions in various ways. Some of them are listed below:

1. Climatic data of nearly all sorts may be greatly supplemented.
2. The general geographic conditions are indicated by the ecological aspects.
3. Slight variations in these general conditions are marked by corresponding changes in vegetation and animals.
4. Many differences in the various climatic factors are revealed.
5. Differences in soils are indicated in many places.
6. The nature of the subsoil and the depth of the soil is revealed at many points.
7. The depth to the water-table is shown in many places.
8. Many slight differences of slope or elevation are made conspicuous.
9. The likelihood that an area will be flooded, or, in case of areas normally submerged, will be exposed, is shown in many places.
10. The value of certain areas for the production of certain crops is suggested.
11. The rate of erosion of slopes is suggested.
12. The directions or points of the compass are indicated roughly by various plants and animals.
13. The physiographic or even geologic history may be illuminated.

These points demand some further discussion:

1. Climatic data of nearly all sorts are greatly supplemented: In mid-latitudes, especially in continental interiors, there may be great climatic variation from year to year and decade to decade. Records of a moderately satisfactory sort cover but a short period for many areas. Therefore in many districts the local climatic records permit only an imperfect knowledge of the climate. By using the dominant species as an index, comparison may be made with corresponding areas which have records that cover a much greater interval.

The dominant native plants and animals of any region have been selected not by the climate of a brief period, a decade or even a century, but by that of centuries. The study of the native biota therefore makes possible in many places a very great extension of knowledge concerning the climate.

2. The general geographic conditions are indicated in most places by the ecological aspects of the biota, and therefore supply indices for comparison of areas: Plants closely similar in appearance (ecological aspect) have evolved in various plant families under the influence of similar conditions. Certain spurges in the drier parts of South Africa very closely resemble American cacti. Arborescent representatives of most families are found in the tropical rain forests; even the grasses and horsetails are represented there by forms which might be classed as arborescent. The plants of grasslands are chiefly herbaceous. Plants resembling the sage are found in all steppes, and the pin-cushion, pillow and carpet types of growth are developed at high elevations or in high latitudes by members of nearly all plant families which are represented there.

If two environments—for example, southern Siberia and western South Dakota—present the same ecological aspects and types, and perhaps many representatives of identical genera and species, the chances are that a species from one environment will thrive in the other, if introduced. Various strains of Siberian alfalfa have been introduced into South Dakota, and some give great promise. The introduction of forms from regions quite unrelated, ecologically, is, on the other hand, much less likely to be successful. The resulting loss may be much greater than the direct loss because of the discouragement to the introduction of new varieties which one failure usually produces.

3 and 4. Minor climatic differences are shown in many places by minor differences in the biota:

The effects of decreased evaporation or increased precipitation are shown by differences in the ecology of different areas occupied by a general ecological type, as between the southern and northern parts of a prairie, steppe or woodland. Plants such as the twin-flower (*Linnea*) or bunch-berry (*Cornus*), which are restricted to the moister or more mesophytic sides of valleys at low elevations in the southern or warmer part of their range, are much more widespread in the northern part, and at higher elevations.

The persistence and velocity of the wind at various exposed

points is shown by the stunted (krumholtz) character of the woody growth, and the direction from which the prevailing winds blow is shown in many cases by the lopsided shape of trees.

As an illustration of the indication of minor temperature differences the following case showing a conspicuous influence of a season somewhat longer than the average and free from killing frosts may be cited. In Harding County, in the northwestern corner of South Dakota, wild plum thickets are numerous and extensive on portions of the slopes of the forested buttes, while they are rare elsewhere in that part of the state. The local Weather Bureau stations, which are all in the valleys, record a frostless season usually too short for even wild plums. Their abundance on the sides of the buttes indicates clearly a longer frostless season at that elevation. An observing horticulturist has located in this belt an apple orchard which has yielded well for several years. Similar belts are indicated by the native vegetation in many other areas.

5. Differences in soils are indicated by the material brought up by burrowing animals and in many places by different types of vegetation.

Some species of plants grow on a great variety of soils; many others thrive best on certain types, while still others are highly characteristic of a single type. Soil conditions therefore may be recognized commonly by the predominance of different species of plants, and often may be differentiated when seen even from a distance by the shades of color that dominant species give to such areas. A better illustration of this can scarcely be found than at the northeastern corner of the Black Hills, where, from Bear Butte, more than a dozen types of soils, weathered from numerous rock formations which outcrop thereabouts, are distinguishable by the aid of their vegetal covering. On the heavy clay, chenopods and wheat grass give a dark green or brown color. The sandy soil is clothed with tall, stiff, usually straw-colored sand grass, or the reddish-yellow bunch grass. Sandy-loam areas have the shorter, light-colored cover of needle grass which waves conspicuously in the breeze. The clay-loam and silt have a velvet-like buffalo-grama grass carpet. Gravelly areas are blotched with the low shrubs of the lead plant where the matrix is loam; where it is silt, the color is lightened with some species of sage, a genus dominant on many areas of silty soil. In the foothills where sandstones outcrop there are scattered pines; where shale outcrops in that locality, there are no trees. The contact between the limestone and the redbeds

is made conspicuous at a distance of many miles, because pines occupy the limestone to its very margin in most places.

6. The nature of the subsoil and the depth of the mantle rock are revealed at many points.

Materials brought up by burrowing animals are perhaps commonly sufficient indications of the nature of the subsoil.

The thickness of the soil and of the mantle rock is shown clearly in the distribution or character of various species of plants and burrowing animals in areas where firm rock is near the surface.

7. The depth to the water table is shown in places where the depth is not great. The establishment, at such points, of the general water-level makes possible an approximation of the depth to permanent water in wide areas where the depth is too great to be reached by most local vegetation.

The accessibility of underground water is shown strikingly by the distribution of certain kinds of trees. The fringe of cottonwood along the watercourses, the groves of willow, ash, elm, and several other kinds occupying portions of the river bottoms, the little thickets or single trees near hillside springs, all indicate clearly available ground-water.

Various sedges and rushes grow only in areas where seepage takes place, at least part of the time. Lignite, which is relatively impervious, causes seepage in many places where it outcrops on slopes. Vegetation in such zones is fairly conspicuous, and has been used often in locating "coal diggings."

It appears that prairie-dog towns are located only where the water table is within reach of these able burrowers. The location of more than 100 towns examined in Harding, Perkins, Fall River, Stanley, and other South Dakota counties seems to bear out this statement[3].

8. Slight differences of slope or elevation are made conspicuous by differences in the vegetal covering in many places.

In swampy areas very slight differences in elevation commonly are accentuated by distinct differences in vegetation, and in many places the depth of water in lakes and marshes is suggested clearly in the distribution of reeds, sedges, water-buttercups, pond-lilies and other plants. On slight slopes the depressions and the direc-

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[3] The one small town which might at first seem to contradict this generalization is on the table near the north end of the West Short Pine Hills in Harding County. As permanent springs are numerous at the base of the Miocene formation where it outcrops on the margins of this table, some 30-50 feet below the level of the town, it is probable that water may be obtained at a corresponding level beneath the dog town. The selecting of the site for this town might lend support to those who advocate that animals possess the power to reason.

tion of slope are in many places conspicuously indicated by differences in the vegetation.

9. The likelihood that an area will be flooded is shown in many places.

Certain species, notably of grasses and terrestrial animals, are unable to resist even occasional floods, and are lacking in areas where floods occur, while certain plants, such as cottonwood and some willows, become established at the margin of flooded areas and, dead or alive, may long indicate the flood. The biota of areas, normally submerged but occasionally exposed, differs somewhat strikingly in many places from that inhabiting areas permanently submerged. Bodies of water which never freeze to the bottom are inhabited by a richer biota than are those that freeze occasionally.

10. The value of certain areas for crops is suggested in many places.

The significance in this respect of the types of forest is well known, but other plant associations are indicative of value; in grassy plains "land which bears a pure short-grass cover was found to be supplied with water in the surface foot or two of soil only, and usually even to that depth for but a brief period during spring and early summer. Land with a uniform cover of tall grasses was found to be supplied with water to a much greater depth and to offer conditions favorable for plant growth during a much longer season. As a connecting link between these two conditions a short grass cover which supports a scattered growth of taller plants was found to indicate intermediate conditions as regards water supply.

"The areas of greatest agricultural value, one year with another, are those marked by the presence of the wire-grass vegetation. Of almost equal value are the areas characterized by those phases of the grama-buffalo-grass vegetation which are distinguished by the presence of a considerable quantity of Psoralea or of wire-grass. Bunch grass land is best for crops during especially dry years, but is relatively the least productive during favorable years. Typical short-grass land (grama-buffalo-grass association) produces more than any other type during wet years, but is first to fail in time of drought."[4]

11. The rate of erosion of slopes or of deposition is suggested.

In most places bare slopes indicate rather rapid erosion, and slopes covered with vegetation, notably trees, indicate much less rapid erosion. In the sandhills, dunes which have remained rela-

[4] Shantz, H L.: *Bureau of Plant Industry Bulletin No. 201*, 1911, Summary.

tively stationary for a lengthy interval have considerable vegetation, in some cases trees at least on their north-facing slopes.

12. The directions are roughly indicated by certain plants and animals.

The leaves of the compass plant (*Silphium*) usually have their edges in a north-south direction; several kinds of lichens and mosses are found chiefly on the north side of trees and stones; the vegetation on a steep north-facing slope is somewhat markedly different, in most places, from that on a steep south-facing slope; several burrowing animals (ants, badger, prairie-dog), either in the distribution of the material brought up or in the direction of the burrow, give a rough approximation as to directions. Woodpeckers' holes generally are on the northeastern or eastern side of a limb or tree The entrance to covered nests of such birds as the meadow-lark, oven-bird and marsh-wren in most cases is on the east.

13. The physiographic, and even some points in the geologic history, may be illuminated by the distribution of species, especially their presence or absence in areas now favorable to them. Bluffs along most valleys become covered with vegetation soon after the stream ceases to erode at their bases. The age of trees on such slopes, as also of those in ravines and on terraces and alluvial fans, suggests the age of these physiographic features. The presence in the Black Hills of numerous boreal species such as the white spruce *(Picea alba)* and the marmot *(Marmota dacota)* suggests that during the geological past (the glacial period) such species were widespread in this latitude. With the change of climate some have been stranded in the Black Hills. The similarity, or even specific identity, of many Alpine plants of all lofty mountains of the northern hemisphere is probably to be accounted for in the same manner.

IV. Influences of the Biota

In addition to increasing geographic knowledge in the various ways mentioned above, the biota affects run-off, erosion, soil, and evaporation.

The percentage of the precipitation which runs off is affected by the biota. Burrows of worms, insects, amphibians and mammals, footprints of heavy animals, and roots, especially decayed ones, facilitate the entrance of water into the soil. Matted and coarse vegetation especially retards run-off.

Erosion is retarded by a vegetable covering. The disintegration of rock by temperature changes is also retarded by vegetation. The

decay of rock materials by chemical means is facilitated by the secretions and remains of plants and animals. Animals in general accelerate erosion, especially on steep slopes.

Soil is mixed and extended by burrowing animals, which also increase aëration and oxidation. All animals and plants contribute organic matter to the soil. The roots of plants are potent factors in rupturing rock. By retarding the washing away of soil, however formed, plants are powerful agents in the accumulation of a deep soil.

Water which otherwise would run off is conserved in soil clothed with vegetation, and given up gradually by evaporation, which process lowers the temperature and increases the relative and absolute humidity; therefore evaporation of soil moisture normally is increased by the vegetal covering.

V. Biogeography and Human Geography

Human activities in an area are determined largely by the geographic conditions which prevail there. The biogeography reflects but slightly geographic location, area and the mineral resources, though climate, soil, topography, and water conditions influence and are influenced by the biota.

The native biota is a geographic factor of great human significance. The following illustrations applicable to South Dakota indicate a few of its manifold influences:

1. A grassy area facilitates grazing and agriculture, as woods have to be cleared, in most cases laboriously, before extensive tillage or pasturage is possible.

2. Where the sod is tough, laborious breaking necessarily precedes agriculture.

3. Travel across country is facilitated by firm sod.

4. Plains which are covered periodically by dry grass permit of widespread prairie-fires and necessitate foresight, care, and coöperation on the part of the settlers.

5. Where but little of the area is wooded the importation of wood is necessary and wood is valued highly. The small area of woodland in South Dakota is less of a handicap than it might otherwise have been because (a) lumber serves as "return freight" in cars which are used for the export of wheat, cattle and other bulky commodities. In portions of the state which do not export large quantities of such produce the cost of lumber is much

greater; (b) barbed-wire became fairly cheap before it was extensively needed for fencing; (c) ash groves, widely distributed along the valleys, and cedar thickets in portions of the western part of the state furnished a large share of the posts required. The character of the upland (nearly level and heavily sodded) made the hauling of posts and firewood less expensive than it might otherwise have been; (d) lumber mills were erected early in the Black Hills, the forested buttes in Harding County and along the lower Missouri River, and the local demand was supplied, at least for a time.

6. The type of the grassy covering has influenced greatly the grazing industry. In many portions of the earth, grazing is less profitable than in the northern Great Plains. This is due, in no small degree, to the "natural hay" which is formed under the influence of the scanty rainfall of autumn and winter. The growth of many kinds of grass ceases before there are heavy frosts, and the nutriment largely remains in the dried standing grass until the rains of the following summer.

7. Where game birds and mammals were abundant, they made possible the establishment of permanent agricultural settlements before they would have been successful without this assistance.

8. Where fur-bearing mammals are numerous, skins, a natural commodity which usually has high value, are available for export.

The "fur trade" had become unimportant in the Great Plains before permanent agricultural settlement commenced, and therefore it influenced the settlement slightly. However, the trapping of fur-bearing animals has been carried on incidentally by many persons, and has contributed not a little to the firm establishment of many pioneers and some later settlers.

9. Where animals of prey, such as wolves, coyotes, bears, pumas, and horned owls are plentiful, as they formerly were or still are in many parts of the world, their numbers must be depleted before various sorts of live stock and poultry can become very profitable.

10. Where herbivorous animals of certain kinds, such as bison, prairie-dogs, rabbits, locusts, are very numerous, their reduction is an essential antecedent to success in various human activities. The same may be said of poisonous animals and plants.

11. Various animals, especially birds and insects, have been valuable allies of man in his struggle against undesirable animals and plants ("weeds"). Predatory insects, of which there are

many sorts, including various spiders, hymenoptera, and ground beetles, are powerful enemies of numerous plant-eating insects. Various insects, of which the milkweed bug and monarch caterpillar are examples, feed solely or chiefly upon certain weeds.

12. Wild fruits, berries, seeds, nuts, and roots contribute to the food supply of many persons, and in some instances were of great significance to pioneers and others.

OUTLINE FOR FIELD WORK IN GEOGRAPHY*

By WELLINGTON D. JONES and CARL O. SAUER

This outline has been prepared in recognition of the need of defining scope and methods of geographic field work. It is comprehensive enough to be adapted readily to almost any region. Although planned for individual, detailed field research, it also may be helpful in field work of other sorts. Numerous hints on preparations for field work and on field methods are given in order that the inexperienced field-worker may avoid some of the difficulties which commonly are encountered.

I. Preparations for Field Work

1. Reading the literature on the area

a. Before going into the field, the greatest familiarity possible should be acquired with the available literature, including (1) physiographic studies and their geologic basis, and (2) articles on economic and social conditions.

b. Notes should be made on important points. In notes distinguish between abstracts and quotations. Cite author, title, and page. In some cases such notes should be taken into the field.

c. Study pictures from the area. Illustrated pamphlets issued by railroads and steamship lines are helpful in many cases.

2. Acquisition of maps

a. Those available may include topographic, geologic, soil, hydrographic, vegetation, climatic, and land office.

b. Maps not available for field use may be traced or photographed.

c. Maps intended for much use in the field should be cut in sections and mounted on cloth (paper muslin).

3. Outline of campaign

a. Information of value in shaping field plans may be secured by correspondence with (1) well-informed residents of the area, such as merchants, bankers, county officials, experienced teachers, (2) members of geological, forest, and soil surveys.

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* The outline embodies numerous corrections and additions suggested by the Seminar in Geography of the University of Chicago, before which it was presented in the Winter Quarter of 1915. In its preparation use was made of an unpublished outline by H. H. Barrows for a field class in the Cumberland Plateau and Southern Appalachians, of Hayes' Handbook for Field Geologists, and of a paper by D. W. Johnson on "Field Methods in Physiographic Geology," in Economic Geology, Vol. VIII, pp. 713-20. At the suggestion of the Editor, the outline was submitted to Wallace W. Atwood, Isaiah Bowman, W. H. Hobbs, Mark Jefferson, and Bailey Willis. Their comments and criticism have been used freely and hereby are gratefully acknowledged.

Reprints may be secured at cost by addressing Dr. W. D. Jones, Rosenwald Hall, University of Chicago, Chicago, Ill.

b. Before going into the field formulation of the purposes of the field work is desirable. Problems which may be encountered and theories to explain them should be outlined as far as possible. An objective attitude toward preconceived theories is necessary for their successful testing in the field.

c. Make note of places to be studied and estimates of time to be spent at each. Revision of such preliminary plans often will be necessary, especially after reconnaissance (see II, 1, a).

d. The best means of covering the area should be investigated, whether on foot, horseback, with pack animals, wagon, livery rigs, automobile, bicycle, or boat. Effective observation, time, and cost are items to be considered in this connection.

II. Field Methods

1. The itinerary

a. If the region is unfamiliar, it usually is best to begin with a rapid trip through the area, to get general relations in mind.

b. At type localities make intensive studies. These are necessary especially when the major part of the work is reconnaissance.

c. Be sure that all types of areas have been studied before leaving the field.

d. Do not consider it necessary always to cover in a given time all the ground planned.

2. Hints on observation

a. Contrasts and comparisons of parts of the region one with another and with outside regions should be made frequently in the field.

b. Time should be allowed for reflective observation in the field, especially from lookout points, such as hill or mountain tops.

c. Because of the complexity of conditions in most cases, generalizations must be made with extreme care and only after much accurate observation. The geographer needs to guard against emphasizing geographic influences at the expense of non-geographic ones.

3. Getting the view-point of the inhabitants

a. Become one of the people; live with them if possible; take part in their activities.

b. Interview men of authority on local affairs, such as county officers—judges, assessor, clerk, recorder—prominent farmers, bankers, merchants, grain and stock buyers, and newspaper editors. Discount information from real estate agents.

4. Keeping notes

a. The note-book should be of ample size (not much smaller than 5″ x 8″, nor too large to be carried in a pocket), should not contain a great many leaves, and should have stiff covers. Loose leaf note-books, the pages of which can be removed and filed, are recommended especially.

b. Note-books and maps should have, in a conspicuous place, owner's name and address and provision for their return if found.

c. Notes should be taken with a fairly hard pencil. Notes in ink are ruined if they become wet.

d. Record date, locality, and brief title with notes. If loose-leaf note-book is used, date each page.

e. Leave a generous margin, and ample space between notes.

f. Take full, systematic notes in the order of their observation. Ordinarily do not attempt to classify notes at the time they are written.

g. Write general impressions rather frequently.

h. Write résumés before leaving one type of area for another.

i. Distinguish carefully in notes between (1) observations, (2) inferences, and (3) information secured from others.

j. Have a page for noting tentative hypotheses and unsolved problems.

k. Supplement notes with sketches, block diagrams, and profiles.

l. Keep a list of addresses of residents of wide local acquaintance and reliable judgment, to whom you may wish later to write for information.

5. *Use of maps*
   a. If practicable use one field map rather than several, recording all data on the one.
   b. Indicate precisely on map the localities discussed in notes; plot the itinerary.
   c. Some field workers advocate transferring all field mapping to an office map.

6. *Rainy day work*
   a. Write résumés and discussions of topics.
   b. Ink in data on maps and make necessary revisions.
   c. Gather statistics and other geographic data from local sources, such as court-house records, newspaper files, etc.

7. *Collection of views*
   a. Carry a camera (3¼" x 5½" or 3¼" x 4¼"). Use much care in composition and exposure; views are of as much importance as notes.
   b. Record date, location, exposure, purpose for which view is taken, and direction in which camera is pointed. Indicate on map the places at which photographs are taken. Keep a separate page in the note book for a record of photographs (See IV, 3).
   c. From time to time have negatives developed so as to know whether camera is working properly.
   d. Gather good views from photographers, railroad traffic managers, manufacturers, etc.

III. Field Observations

In the following topics the aim is to stimulate observation from all geographic points of view; as a result, there is some duplication under related headings. Few regions have the wide range of material for which this outline provides, so that in most instances a number of topics will not need to be considered. Nearly all regions have special problems for which provision cannot be made in a general outline. Some of the topics, for example, "weather" and "discovery and settlement," cannot be studied to any great extent in ordinary field work. They should, however, be kept in mind, inasmuch as field observations may furnish useful "leads," which later can be expanded and verified. Field work raises many questions which must be solved, if at all, after leaving the field. Obviously, especial attention should be given to observations which have *geographic* content.

1. *Topography*
   a. Elevation above sea-level and amount of relief; relation to grade level.
   b. Larger features (plain, plateau, or mountain); general relations to each other; relation of region to its surroundings.
   c. Character in detail. Upland: area, distribution, direction and angle of slope. Valleys: distribution, size, shape, and trend of main and of tributary valleys, angle of slope of sides and gradient of floors, extent of flood plains, terraces, relation of size of streams to size of valleys. Configuration of the border between upland and lowland.
   d. Types of topography, in terms of their origin: influence of rocks and rock-structure, of gradient, of physiographic processes involved in shaping topography, of stage in cycle of erosion, and of previous cycles of erosion. In regional geography physiographic processes and history need be studied only in so far as their understanding makes possible causal descriptions of topography, drainage, and soils, such description giving in most cases the clearest picture.
   e. Topographic provinces: bases of differentiation, and character of boundaries.
   f. Effects of topography on climate, vegetation, animal life, industries, transportation and people.

2. Drainage

a. Streams and stream systems: number, width, depth and volume of streams; variations in flow, areas flooded, frequency and duration of floods; gradient, erosion and deposition, configuration of channel, changes of channel, nature of bed; origin, age, adjustment or lack of adjustment to rock structure and drainage changes; drainage mesh; area and character of drainage basin.

b. Lakes and ponds: distribution, number, size, depth, relation to streams and underground waters, character of shores; origin, changes in level, area, nature of shore and salinity.

c. Swamps and marshes: extent, distribution, character, relation to stream flow; origin and changes.

d. Underground drainage: relation to number, size, and flow of streams; variations in level of water table; springs (and wells), distribution, size, fluctuations of level and flow, character of water, relation to rock structure; features developed, such as caverns, sinks, and natural bridges.

e. Relation of drainage to climate, vegetation, water power, navigation, land transportation, industrial, municipal and domestic water supply, irrigation, use and reclamation of wet lands, health resorts and recreation grounds, and distribution and character of population.

3. Soils

a. Types: distribution; physical character, origin, mineral composition, texture, humus and water content, depth and nature of subsoil; soil provinces.

b. Relation to native vegetation.

c. Utilization as affected by drought resistance, ease of erosion, rate of exhaustion, ''warmth'' or ''coldness''; kinds and qualities of crops grown; use of soils not suited to agriculture; land values on different soils.

d. Problems of soil conservation: restoration of worn-out soils; checking soil erosion; improvement of defective soils, such as acid, alkali, ''gumbo,'' and ''hardpan'' lands.

4. Mineral resources

a. Kinds: distribution; structural, physiographic, and climatic conditions affecting distribution, quality, quantity, and accessibility.

b. Development (see III, 12, c).

5. Weather and climate

a. Weather observations: daily range of temperature, absolute maximum and minimum temperatures, length of growing season, likelihood of frosts at beginning and end of growing season; sensible temperatures, humidity, rate of evaporation; cloudiness and sunshine; dews, mists and fogs; seasonal distribution, frequency, and character of rain, hail, and snow, duration of snow cover; strength and direction of winds, changes in wind directions; storms; frequency of changes in weather; etc. Local Weather Bureau men may furnish valuable data.

b. Inferences concerning climate from the character of the topography, soil, drainage, vegetation, and crops.

c. Climatic provinces: bases of determination; width of transition zones.

d. Evidences of change of climate.

6. Coasts and shores

a. Coast lines: horizontal and vertical configuration; headlands, peninsulas, islands, bays, sounds, beaches, bars, spits, marshes, and other features; origin and age of coast line, including changes of level, erosion of headlands and islands, deposition on- and off-shore; character and origin of harbors.

b. Tides, shore-currents, waves: work of each in modifying coasts.

c. Influence of coastal conditions on shipping, fishing, health and pleasure resorts, distribution of population.

7. Plant life

a. Native vegetation: characteristic species, vegetation associations; aspect, density, luxuriance, and distribution in relation to climate, soil, water table, and topography.

b. Influence on settlement and development of the region; changes in vegetation due to man.

8. Animal life

a. Types of animals, character and distribution with reference to vegetation, climate, topography, and soil.

b. Influence on settlement and development of the region; changes in animal life due to man.

9. Characteristics of the people

a. Physique, health, traits.

b. Social conditions: customs, dress, speech, religion, and political status.

c. Buildings: architecture, materials used, furnishings, condition in which kept.

d. Races: distribution, characteristics; influence of environment, with special reference to different development of different stocks in the same environment, and to survival of traits and institutions acquired in a previous environment (a fundamental geographic problem of great complexity, the interpretation of which requires great care and in many cases cannot be undertaken).

10. Exploration, settlement, and development

a. Explorations: time and character, routes taken, influence on settlement.

b. Settlements: locations and reasons for their choice; nativity of settlers, routes of approach of settlers; occupations and mode of living, means of communication, and political organization.

c. Stages in the development of the region.

11. Distribution of population

a. Density of population and changes of density as affected by geographic and other factors.

b. Rural population: distribution; sites and plans of villages and individual farm groups; rate of growth as compared with that of urban population.

c. Urban population: location, size, growth, and plan of cities; commercial, residential, and industrial districts; distribution of population by race, income, etc.; population density and land values by districts.

d. Immigration and emigration: sources and destinations; reasons for movement, and economic, social, and political effects.

12. Economic activities

a. Agriculture. Types of farming: (1) the growing of field-crops; size, location, and form of farms and of fields; proportion of land tilled; crops, variety, yields, advantages and disadvantages of each crop; husbandry; markets and marketing methods; (2) stock-raising: size and location of farms, proportion of land used for grazing; kinds and quality of animals, size of herds; methods of raising, preparing for market, and shipping; advantages and disadvantages of the region for stock-raising; (3) combination of crop-farming and stock-raising ("mixed farming"); (4) dairying, poultry-raising, gardening, and fruit-growing, as part of the general farm economy, and as independent industries. Values of land, proportion of improved and unimproved land, size and use of wood-lots; type and value of farm improvements, such as outbuildings and fences; influence of type of farming on distribution of population and social conditions; changes in farm practice, introduction of new crops and new types of farming; extension or restriction of producing area.

b. Forest industries: location and size of forests; character of timber, as to species, density, and quality; methods of cutting and logging; character and distribution of lumbering, wood-pulp, and wood-working industries; other forest industries, such as turpentining and tan-bark

gathering; by-product industries; value of products; transportation and markets; future developments, needs and possibilities of conservation; relation to farming and manufacturing; conditions and characteristics of the workers.

c. Hunting and fishing: products; possibilities of domesticating animals; economic and social influences, especially in the early development of the region.

d. Mineral industries: (see III, 4) distribution of mines, pits, quarries, and wells; methods of production, losses, and wastes; availability of power; markets; competing regions; effect on other industries; future of the mineral industries and influence on the future of the region; nature of mining centers, life and characteristics of the miners.

e. Manufactures: distribution as determined by raw materials (local or imported), power, labor, transportation, markets, capital, early start, and individual initiative; size of establishments; growth and changes of industries; relation of manufacturing industries to each other and to other industries at various stages in development of region; relations to competing areas; social conditions and political interests; future of existing and possibilities of new industries.

f. Transportation: trails, roads, rivers, canals, lakes, and railroads; distribution and character of routes as affected by topography, soils and rocks, drainage, climate, vegetation, natural resources, industries, and population; significance in the development of the area; effect of transportation conditions on the activities and character of the people; transportation problems at different periods.

g. Commerce: trade within the region and with outside regions; commodities exchanged, places from which they come and to which they go; methods of transportation; package or bulk freight; trade routes; trade centers, cities, towns, country stores, areas tributary to each, competition between centers, advantages and disadvantages of each center, trade general or specialized; bartering; changes in character of trade in past and probable future changes; influence of trade on distribution and character of population.

h. Recreation and tourist business: types of resorts, attractions, length of season, sources of visitors; accessibility; general influence on localities concerned.

i. Relative importance of different economic activities; degree to which specialization of individual workers has taken place.

13. Geographic provinces

a. Distinguish as geographic provinces regions within which there is essential unity of physical environment and consequently of economic conditions (Dryer). Topography, drainage, climate, vegetation, soils, mineral resources, and position with reference to other regions should be considered in differentiating such provinces.

b. Boundaries: how determined, clear or indistinct (transition zones); relation to political boundaries.

IV. Office Work after the Field Season Preliminary to Writing Report

1. Transcribing field-notes.
   The chronological field-notes should be transcribed under topical headings; cross-references in some cases desirable. One of the most convenient methods is the use of loose sheets or cards, which, together with reading notes, can be filed according to topics.
2. The original field-notes and maps should be accessible while report is being written.
3. Numbering and filing of negatives.
   Negative albums are convenient for the filing of films. (The Eastman negative album is one of the best.) A number should be put on blank margins (not the developed portion) of each negative in water-proof India ink. Title of negative, with date and place, should be written on each negative envelope in pencil.

GEOGRAPHIC NOTES ON THE WAR

By DOUGLAS W. JOHNSON

The Austro-Italian Frontier:

Italy's entrance into the war, and the prompt initiation of an Italian offensive movement, naturally direct attention to the physiographic aspects of the Austro-Italian frontier which extends from the eastern end of Switzerland to the head of the Adriatic Sea.

The Alps consist of a mass of complexly folded and faulted mountains which were probably reduced by subaërial erosion to a peneplane surface, then uplifted and maturely dissected by stream erosion, and later profoundly glaciated. The mature stream dissection may alone have been sufficient to destroy most of the former upland surface throughout the main part of the range, leaving broad-shouldered mountain ridges and rounded domes separated by deep-cut valleys; but glacial erosion over-steepened the valley walls, over-deepened the valley bottoms, and sharpened the ridges and domes into knife-edge arêtes and tooth-like alpine peaks. There resulted a topography of exceptional ruggedness, in which precipitous cliffs, inaccessible peaks, steep-sided divides and hanging valleys present to the engineer almost insurmountable difficulties. Roads and railways are for the most part restricted to the bottoms of glacial troughs and to the few passes across intervening ridges. Where they are forced against the rocky wall by a lake occupying the trough floor, or lead upward over dissected mountain slopes, tunnels and bridges are numerous. Military movements through such country must of necessity be slow; the lines of advance are few and narrow, and easily blocked by the destruction of bridges and tunnels; they are dominated by commanding peaks from which hostile artillery can be dislodged only by a slow and painful advance over most difficult topography; and important passes must be wrested from the control of the enemy under conditions which make defense easy and offense hazardous.

Stretching southward from the southern foothills of the Alps is the alluvial plain of the Piedmont, formed of rock débris eroded from the mountains and spread out in great fans along the mountain base. The rivers which made this alluvial deposit flow southeastward down its slope to the Po or to the Adriatic, some with meandering courses while others were so overburdened with débris that they developed a braided pattern about countless island sandbars. Near the sea the plain is very low and marshy, and characterized by extensive lagoons back of narrow barrier beaches. This lagoon and marsh belt varies in width from 10 to 30 miles or more, and interposes a serious obstacle to the movement of troops; but between the marshes and the mountains only the transverse rivers oppose the ready advance of armies over the level surface of the plain. These rivers have played an important rôle in Italian military history in the past, and may do so again in the near future.

Almost all of the Austro-Italian frontier lies in the difficult country of the Alps. Only at the extreme east does the international boundary descend to the plain and run across its nearly level surface for 20 or 30 miles to the head of the Adriatic Sea. Even here an important advance from Italian to Austrian territory is not so easy as might appear from the definition of the frontier; for just east of the political boundary the Piedmont Plain ends abruptly against the base of the mountains which bend southward from the Alps to border the Dalmatian coast. No appreciable advance into Austria is possible except over difficult mountainous country.

That portion of the international boundary lying in the Alps is located in a position which, from the standpoint of military strategy, is highly unfavorable to Italy. It lies close to the southern edge of the mountains, near the Piedmont Plain. Austria has the advantage of possessing most of the rough country as a bulwark against Italian aggression, but may herself sweep down upon the

Italian plain with a minimum of difficulty. Much of the boundary line follows along minor crests, dominated in many places by higher ridges to the north. In part it runs transverse to the grain of the country, repeatedly descending to a low level in order to cross the bottoms of main glacial troughs and minor valleys which trend roughly from north to south. Through these valley depres-

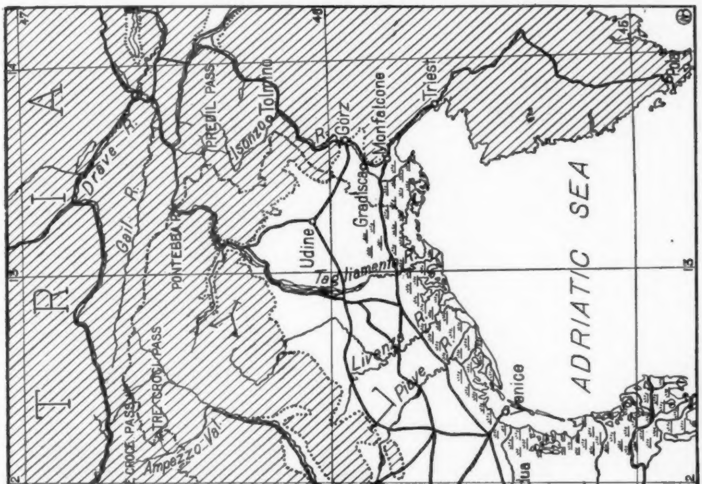

Fig. 1—Map of the scene of operations of the Austro-Italian campaign. Scale, 1:2,400,000. The shaded areas represent mountains.

sions Austria may move down-stream across the boundary into Italy, while Italian troops must always work against gravity in advancing into Austria.

The plains portion of the frontier is easily crossed in either direction. But just east of the boundary line, and parallel to its bendings is the Isonzo River, its upper portion occupying a glacial trough in the mountains, its lower part

flowing with a somewhat braided pattern through a marshy floodplain on the sloping surface of the Piedmont, to end on a delta projecting into the northern end of the Adriatic. This natural line of defense is not only the first obstacle to a further invasion of Austria, but also serves as a special protection for the important railway line just to the east which connects the interior of Austria with its principal seaport, Triest. East of the railway rise the mountains already mentioned, which terminate the Piedmont Plain in this direction.

Immediately upon the declaration of war Italy seized the initiative and launched two offensive movements against Austria, one northward across the mountainous frontier, and one eastward across the plains frontier. The former movement is mainly concentrated against that portion of the southern Tyrol known as the Trentino, which projects southward like a triangular peninsula into northern Italy. There are many reasons why the Trentino should be the object of one of the two campaigns first undertaken by Italy. As a "lost province" largely inhabited by Italians its occupation is calculated to inspire enthusiasm in the army of liberation and in the breasts of the people who must support the army. As a salient of hostile territory thrust far into Italy the Trentino constituted a danger which could be removed only through its conquest. Of all the glacial troughs leading southward through the Alps, the valley of the Adige (Etsch) which bisects the Trentino from north to south is one of the most remarkable, and is economically and strategically the most important. Its flat floor, from less than one mile to more than two miles broad, is traversed by two excellent carriage roads and by a railroad of the highest possible strategic value. By way of the low Brenner Pass (4,495 feet) both carriage roads and railway afford the chief means of communication between Italy and Germany, while the railway is the only line by which Austria can send reinforcements, ammunition and supplies to the Trentino. The fortified town of Trent, and the outlying fortress of Rovereto 12 miles farther south, both lie in this same trough. It is the richest valley, the chief commercial route, and the easiest natural line of invasion open to the Italians, besides containing the towns whose capture would have the greatest military significance.

Fortunately for Italy there are other routes of invasion converging on Trent, so that the difficulties of advancing along the narrow Adige valley are to some extent offset by the opportunity of coöperation with supporting columns in neighboring valleys. The southern apex of the Trentino peninsula may be entered through the glacial trough just west of the Adige occupied by Lake Garda and the Sarca River, or farther west by the parallel trough occupied by Lake Idro and the Chiese River, and known as the Giudicaria Valley. At the time these notes are written Italian armies are advancing northward through all three of these glacial troughs, and fierce fighting has been reported on Monte Baldo, the high ridge which separates the Adige and the Garda-Sarca troughs and dominates military operations in both.

From the two sides of the Trentino peninsula flank attacks against the Adige Valley and its important railway are possible by way of other glacial troughs and mountain passes. On the eastern side the great trough of the Brenta River, known as the Val Sugana, may be followed westward to where it heads on a low col at the very gates of Trent. A railroad through the valley adds to its strategic importance, and a large Italian army is now moving on Trent by this route. Other armies are advancing toward or have already seized the Monte Croce Pass (5,374 feet), Tre Croci Pass (5,932 feet), Ampezzo Pass (5,066 feet), Rolle Pass (6,509 feet) and other passes by which carriage roads cross the mountain ridges from Italy into the eastern side of the Trentino. On the western side an important advance has been made through Tonale Pass (6,181 feet) apparently with the object of advancing eastward to the Adige Valley in order to cut the railway north of Trent and isolate that fortress, and to turn into an Austrian disaster any attempt to retreat northward through the valley. The Trentino campaign is fairly under way, and while the extreme ruggedness of the country will make every advance difficult and costly, events of decisive importance may have taken place before these notes appear in print.

The second campaign with which Italy began the war was launched across the plains portion of the international frontier, with Triest as the first important objective. From the railway center of Udine as a base of operations,

Italian troops advanced across the Friuli border and occupied the belt of territory between the boundary and the Isonzo River without difficulty. Two Austrian towns located on the river, Görz and Gradisca, early figured in the dispatches because of resistance encountered by the Italians at these strategic points on the natural defensive line formed by the stream with its braided channels and marshy valley floor. Operations were further delayed by floods in the river; but Italian forces made good their passage at several points further south, capturing Monfalcone, a town located at the strategic point where the railway to Triest leaves the plains to enter the mountain belt. Whether the "marshes of Gradisca" can long protect the railroad farther north remains to be seen. North of Görz the Isonzo River flows in a deep trough through the mountains which is occupied for a part of its length by the railroad already mentioned, and throughout its whole course by a carriage road which leads northward over the Predil Pass (3,810 feet) into the headwaters of the Drave. Control of this part of the valley is therefore also important; and Italian forces have crossed it near Tolmino, bombarding that town from the adjacent heights of Monte Nero.

The campaign for the possession of Triest, and ultimately of Pola, the great Austrian naval base on the Istrian peninsula farther south, is therefore only started. Triest is dominated by a bold mountain ridge on the northeast, from which Austrian artillery can command every approach to the city; and from Monfalcone to Triest the Italians must traverse mountains which descend boldly to the sea. From the physiographic standpoint the hardest part of their task is yet before them.

Between the armies operating in the Trentino and Triest districts, Italian troops are securing or attempting to secure all the intervening passes across the mountains which might be utilized by the Austrians for offensive purposes. Among these the most important is the low Pontebba or Pontafel Pass (2,615 feet), through which runs the railway connecting northeastern Italy with central Austria.

Should the Italian offensive fail, and Austrian troops invade Italy, one of their objectives would probably be Venice. From the base of the mountain to the margin of the lagoon belt there is no serious natural obstacle to troops advancing from the north. Armies moving from the east, on the other hand, would have to cross one after another of the parallel rivers which flow down the slope of the plain. These successive defensive lines would be utilized by the Italians to retard an Austrian advance, and should cause invading armies serious embarrassment. Some of the rivers, particularly the Tagliamento and the Piave, have an extraordinarily braided pattern, the interlacing network of channels being crossed by good roads only at infrequent intervals. On the banks of both these streams important military actions have occurred in the past, and in this respect history will repeat itself in the near future if during this war the Teutonic allies prove able to prosecute an extended invasion of Italy from the east.

GEOGRAPHICAL RECORD

THE AMERICAN GEOGRAPHICAL SOCIETY

Gift of an Old Manuscript Map to the Society. A manuscript map entitled "British Guyana, comprehending the colonies of Berbice, Demerary and Essequibo captured from the Dutch by the English in 1795," scale 3 miles to an inch, has been presented to the Society by L. F. Massa, Esq., of Fort Lee, N. J. The map (4 x 6 feet) was compiled by Theodore Barrell, a Boston trader, from notes taken in Demerara, 1791 to 1804. The region lies between 5°30′-7°40′ N. and 56°40′-59°30′ W. The positions and shape of the plantations and the names of the owners are given. Roads and trails with copious information written in a neat hand cover the map surface. Blank spaces are filled with notes conveying much insight into the state of development of the colony and its production for the period of observation.

NORTH AMERICA

The American Association for the Advancement of Science at San Francisco. Special arrangements have been made for the members of the Geological Society of America and of the Association of American Geographers who expect to attend the sessions of the American Association at San Francisco beginning on August 2. A special train over the Santa Fe Road leaving Chicago on July 23 at 10.30 P. M. will be provided, and numerous stops and short side trips have been arranged for visits to points of particular geological interest and especially places best showing the features of desert erosion.

Eruptions at Mt. Lassen. The eruption at Mt. Lassen on May 19 was more than usually violent. The volcano has now become a subject of coöperative study by the Geological Survey and the Forest Service. Officers of the Lassen National Forest have been instructed to keep a record of the activity of the volcano as a basis for further scientific investigation by J. S. Diller who will reach Lassen early in July. It is not known whether a cloudburst started the latest great eruption by precipitating rain upon the molten lava in the crater or whether melting snow on the peak and the resulting flooding of the crater with water caused the accumulation of steam which blew a river of mud out of the mountain. Mr. Diller, last year, inclined toward the melted snow theory; and the reflection on the clouds of the red hot matter uncovered by the eruption indicated that the volcano was in a more or less dangerous mood. The enormous quantities of mud expelled with immense energy from the north side of the crater and down Hat Creek have damaged government and private property and destroyed bridges necessary for the entrance of live stock that are grazed on the forest range in the summer.

Variation of Human Activity according to the Seasons. Mr. Ellsworth Huntington has recently visited Hampton Institute, where at his suggestion, for three months, a series of daily tests both mental and physical had been made upon 11 boys and 11 girls. The purpose is to continue the tests for about a year longer. "We shall thus have a full year's record and shall be able to see how human activity varies according to the seasons. The tests will be of special value because they will form the only series where the activity of the mind has ever been tested on so large a scale for a long period. They will bring out not only the effect of the seasons and of different degrees of humidity but also the degree of variability among individuals and the difference between the white and negro races. After three months the students are still as keenly interested as at the beginning."

Relation of Past and Present Climate to Life. A letter from Dr. Ellsworth Huntington dated April 14 says that he was then en route for the Mohave Desert and its neighbors, including Death Valley and the Searles, Panamint and Owens Basins. The Desert Laboratory of the Carnegie Institution of Washington proposes there to carry on a somewhat broad study of the relation of past and present climate to life. Drs. D. T. MacDougal and Forrest Shreve will study the botanical aspects, Mr. E. E. Free will work on the chemical and physical qualities of the recent lacustrine and alluvial deposits, and Dr. Huntington will investigate the remarkable series of old strands and other allied phenomena. They hope also to have coöperation on other sides. For example, Mr. F. E. Matthes, as part of the work of the U. S. Geological Survey, has made important observations upon some recent moraines. These various lines of evidence as well as Dr. Huntington's measurements of Big Trees in the same region point to recent climatic pulsations. The question to be solved is whether there is any way of correlating the various lines of evidence—botanical, chemical, glacial, lacustrine, and fluvial.

The Reported Discovery of Large Islands in Hudson Bay. The surprising announcement has been made from Montreal that some hitherto uncharted islands of very large extent have been discovered near the center of Hudson Bay, by Mr. Robert J. Flaherty, "leader of the Sir William Mackenzie expeditions to Hudson Bay." The islands are said to extend from north to south nearly 400 miles, and to have a total area of over 4,000 square miles. They are said to consist of low hills, and to be uninhabited save by Eskimo in a few places. They correspond to what have been known as the Belcher Islands, but are of much greater area. This discovery, if at all answering to the above report, is evidently of very great interest and may be expected to throw some light on the obscure accounts of Hudson's last voyage. The Belcher Islands are shown on the Admiralty charts as two groups of small islets between 56° and 57° N. lat., and somewhat over 100 miles from the eastern shore of the bay. According to Hessel Gerritz's statements, and his map said to have been copied from Hudson's own, Hudson sailed up the western shore to 60° then meeting with a "wide sea, agitated by mighty tides from the northwest." Commentators have declined to accept the given latitude, and some (*e.g.* Mr. Miller Christy in his 'Voyages of Foxe and James') have thought the point mentioned to have been the northern extremity of James Bay, in 55°. But it now seems possible that Hudson sailed up the east side of the newly examined islands, in which case a latitude approaching 60° might perhaps have been reached before the open sea to the northwest was discovered. (*Geogr. Journ.*, Vol. 45, 1915, No. 5, p. 440).

The Topographic Map of Pennsylvania. A little more than half of the area of Pennsylvania has now been covered by topographic sheets. The Topographic and Geologic Survey Commission of the State has just issued *Report* No. 7, which contains the large mass of engineering data that has accumulated during the survey, such as the determined positions of many places both horizontal and vertical, magnetic determinations, etc., all of which are of great and increasing value to the engineer and the surveyor.

New Vessel for the Coast and Geodetic Survey. The Department of Commerce has purchased for the Coast and Geodetic Survey the steamer *Isis*, which has gone to Washington to complete her equipment. Wireless apparatus and sounding machinery will be installed and the vessel will be supplied with equipment for wire drag work. The *Isis* was purchased from the estate of T. S. Spaulding for a little less than $60,000. She was built in 1902 at a cost of about $225,000 and could not be duplicated for that price at the present time.

Summer School of Forestry. The New York State College of Forestry at Syracuse University will hold its summer forest camp in August on Racquette Lake. This camp of instruction along forestry lines was started in 1914 to meet the demand for a short course in forestry. The instruction will be largely field work in elementary forestry and woodcraft. From two to five instructors will be constantly in the camp.

SOUTH AMERICA

Work on the Bolivia-Brazil Boundary Completed. The Joint Commission of Bolivia and Brazil continued and concluded last year the exploration and delimitation of the frontier line of the two countries along the rivers Abuna, Rapirran and Madeira. One of the notable features of the work was the utilization of wireless telegraphic time signals from the powerful wireless station at Porto Velho to determine longitudes further west. Porto Velho, some 1,500 miles from the Atlantic, stands at the head of navigation on the Madeira River and from it extends the forest railroad around the series of remarkable rapids and falls that make the upper Madeira unnavigable. Commander Herbert A. Edwards, who had charge of the party, has a paper on the work in the *Geographical Journal* (Vol. 45, 1915, No. 5, pp. 384-402. Map, p. 456).

The wireless party in charge of Mr. C. C. Chapman did excellent work. The aerial wire was always stretched across as high as possible between two or three convenient trees. The wireless station was erected at every camp and time signals were received each night from Porto Velho, thus enabling the party to establish most successfully the longitudes of their camping places, which were used as controlling points between which the river traverses were adjusted. Commander Edwards says: "I believe our wireless work to be the pioneer in regions of dense forests, and we have proved the utility and feasibility of wireless determinations of longitude over comparatively long distances under most unfavorable climatic conditions."

Channel Improvements at the Mouth of the Rio de la Plata. The increasing size of the steamers entering the harbor of Buenos Aires has led Argentine authorities to consider deepening the channel at the entrance of the Rio de la Plata to a depth of thirty feet. The depth of the channel leading to the city wharves had been increased to twenty-six feet at low tide by dredging systematically conducted to the year 1911. A description of the engineering operations required is contained in the *Boletín de Obras Públicas de la República Argentina* for the second semester of 1913 (Nos. 1 to 6, July-Dec., Vol. IX). The work will also necessitate cutting through the Punta de India bank, which extends across the mouth of the river from the Argentine to the Uruguayan shores.

AFRICA

Physical Maps of the Italian Colonies. That the physical map is the fundamental cartographic representation of a region may be considered a geographic axiom. Its predominant use, in those countries where geography is highly developed, for teaching purposes, is a recognition of this axiom. The maps in the German school atlases are perhaps the best examples of this type. Their range is naturally dictated by national considerations, *i. e.* the scale of each map is chosen according to German interest in the region it represents. If, therefore, new physical maps appear on a scale larger than hitherto available for a given region, it is a matter of satisfaction to the geographer, particularly if their manner of execution is equal to the highest German standards. This is the case with various maps of the Italian colonies which are included in the recently published second edition of Professor De Agostini's "Atlante Geografico Metodico" (Istituto Geografico De Agostini, Novara). Pl. 56 *bis* represents Libya on the scale of 1:12,000,000; Pl. 57, the Abyssinian highland and surrounding regions in 1:12,000,000; Pl. 58, Eritrea, 1:3,000,000; and Pl. 59, Benadir (southern Italian Somaliland), 1:3,000,000. These maps represent relief in the approved way of hachuring and elevation tints combined. Similar physical maps are contained in the first half of Professor Marinelli's "Atlante Scolastico di Geografia Moderna" (Antonio Vallardi, Milan, 1913), *viz.*, Pl. 20, Tunisia, Libya and Egypt, 1:10,000,000, with insets, and Pl. 22, Eritrea, Abyssinia and Somaliland, 1:10,-000,000, with insets. These maps show relief by elevation tints only; a comparison with the corresponding maps in the De Agostini atlas shows how much less expressive this method used alone is than when combined with hachuring. The omission of hachuring on the physical maps in the Marinelli atlas is all the

more regrettable as it is used on the corresponding political maps. Printing this feature also on the physical maps would greatly have enhanced their value.

Two other maps should be mentioned which, while not representing relief primarily, represent the physical features of critical importance in arid regions, *viz.* the cultivable areas and the different kinds of desert. These are Dardano's "Carta della Tripolitania e Cirenaica," 1:5,000,000, with insets, and the same author's "Le Nuove Provincie Italiane: Tripolitania e Cirenaica," 1:2,500,000, with insets, both published by De Agostini, Novara, and reviewed under "Tripolitania" in the *Bulletin,* Vol. 44, 1912, pp. 238 and 717 respectively.

ASIA

Sir Aurel Stein's Remarkable New Discoveries. Sir Aurel Stein sent a report on his work in Chinese Turkestan, from April to November last year, which appears in the *Geographical Journal* (May, 1915, pp. 405-411). He paid another visit to the cave temples of the Thousand Buddhas near Tenhuang and was richly rewarded. He followed the wall for about 250 miles. It had been built with its watch towers and small military stations across what, already in ancient times, was absolutely sterile desert. It was a remarkable construction made of carefully secured fascines of reeds or brushwood with clay or gravel layers between them.

Beyond the sharp bend made by the Su-lo Hu valley there were abundant finds of ancient records on wood, also furniture, many kinds of implements, etc., which were brought to light at the ruined watch stations. The evidence shows that all these had been left behind by Chinese soldiers who, during the first century before and after Christ, had guarded the frontier. The explorer was much impressed by the engineering skill which adapted the defensive line of the wall to different local conditions.

Meanwhile his surveyor, Lal Singh, went in another direction to survey practically unexplored regions. The observations made upon the hydrography of this now desert region are full of interest. Traces of extensive irrigation works abandoned long ago were found. The ruined town of Khara-Khoto was examined and its position and remains showed that this was Marco Polo's "City of Etzina," where in ancient times travelers to Karakoram, the old Mongol capital, had to lay in supplies for forty days in order to cross the great desert.

At the ruins of this town many valuable relics were secured—Buddhist manuscripts and prints, fine stucco reliefs and frescoes, household utensils, records on paper, coins, metal and stone ornaments, etc. The abandonment of the settlement must have been caused by the difficulty of maintaining irrigation. Before the expedition arrived at Turfan, from which Sir Aurel Stein sent this report in November last year, many valuable additions were made to his previous work, both archæological and geographical. Sir Aurel Stein proposed to devote a few months to the many ruined sites of Buddhist times around Turfan, while his surveyor was to map the extensive and little-known desert ranges of the Kuruk-tagh between Turfan and Lop-nor.

Recent Philippine Surveys by the Steamer Pathfinder. The Coast and Geodetic Survey informs the Society of some recent significant soundings by the steamer *Pathfinder* in the southwest part of the Philippines area. The Cagayanes, Cavilli and Arena Islands, Tubbataha and Maeander Reefs, in the Sulu Sea, are apparently coral capped summits of a submerged mountain range extending for 200 miles southwesterly from the southwest part of Panay Island. They rise from depths of 6,000 to 12,000 feet with a stupendous submarine slope. The soundings indicate that this range divides the Sulu Sea into two deep basins by joining the shelf or plateau extending northwest of Borneo and east of Balabac Strait. Bancoran Island and Moyune Reef are elevations at the south end of the northwest basin.

The Tubbataha Keys and Maeander Reef are the only elevations without vegetation. They are steep faced, similar in structure and consist of an accumulation of dead corals, coral rock and coral sand cemented into a greater or less degree of compactness. The pounding of the sea has accumulated the coral sand in the center to an elevation of five or six feet.

The sounding lines were confined mostly to the steamer track from the south point of Panay Island to Nasubata Channel, and from the south of Negros Island to south of Cavilli and Arena Islands. 214 deep sea soundings were taken along the track, covering about 5,050 square miles. The deepest sounding (18,294 feet or nearly 3½ miles) was in 8°50′ N., 121°50′ E. A temperature of 53° Fahr. was obtained at 2,420 fathoms. The lines of soundings from Iloilo Strait and the route around the south end of Negros to Tubbataha South Islet show depths from 1,100 to 3,000 fathoms. The 2,000 fathom curve comes within twelve miles of the south side of Cavilli Island. Depths of 700 fathoms are within four miles of the keys and islands. It appears that a ridge with 700 to 900 fathoms over it extends between Cavilli and Tubbataha, and possibly much less water would be found on a direct line between the islands and cays. Southwest of Tubbataha there is a general depth of 1,150 fathoms to within thirty miles of Bancoran Island. From Bancoran westward the water shoals gradually from 600 fathoms to 60 fathoms.

EUROPE

Native Races of Great Britain. Mr. William H. Babcock read a paper before the Washington Academy of Sciences on Feb. 16 entitled "The Races of Britain" which is summarized in the *Journal* of the Academy (Vol. 5, 1915, No. 10, p. 375). Mr. Babcock pointed out that three native languages are spoken in the islands of Great Britain—English over the larger part of it, Welsh in parts of the western mountains and Gaelic in the northern mountains—a situation which was the same in the latter part of the sixth century, excepting differences in the area of each. These languages represent three distinct waves of invasion by people who were blond when of pure blood; yet the present population contains a great number of brunettes or persons of medium tint and this type seems to be gaining on the blond type. The best explanation seems to be that the blond conquerors found in Britain a long-established and thoroughly acclimated darker population which perhaps remained more numerous than the newcomers and certainly were better adapted permanently to transmit its characteristics. This was composed mainly of a fairly advanced neolithic race, probably from southern Europe, with whatever paleolithic stocks may have been absorbed by them. The historic conquests of Great Britain—Roman, Saxon, Danish, and Norman—have not changed the essential result, which consists of a darker substratum gradually gaining on superimposed Celtic and Teutonic layers.

Relative Humidity Charts of England and Wales. The "Distribution of Relative Humidity in England and Wales" is discussed by W. F. Stacey in the *Quarterly Journal of the Royal Meteorological Society,* Vol. XLI, 1915, pp. 45-61. The author has prepared mean monthly and annual maps of relative humidity based on the 9 A.M. observations made at more than ninety stations during the ten years 1901-1910. An examination of these maps shows that in winter the air over the interior of the country is more moist than over the coastal regions; that the minimum relative humidity occurs earlier in the year in the western parts of the country than in the eastern; that in summer the air over the interior of the country is drier than over the coastal regions, and that the smallest range of relative humidity is found in the west and the greatest in the interior towards the east. The distribution of temperature is the chief determining factor in the distribution of relative humidity, while the sea influence, the direction and character of the prevailing winds, and the configuration of the country all have important effects on temperature, and therefore on relative humidity.

R. DeC. Ward.

Victims of the War. James Blaine Miller of the Coast and Geodetic Survey was one of the victims of the *Lusitania* tragedy. He was thirty-two years old, a graduate of Oberlin College, entered the service of the Survey in 1903 and during his twelve years there was employed chiefly on hydrographic and leveling work in various localities. He had commanded four of the survey steamers in Porto Rico, Chesapeake Bay, the Philippine Islands, the Hawaiian Islands and on the coast of Alaska. He was a hard and indefatigable worker and completed a large amount of valuable service.

Dr. August Wolkenhauer, Privat Docent at the University of Göttingen, was killed in battle in the Forest of Argonne on Feb. 25. He was 38 years old. He developed special interest in the history of cartography, to which his most important papers related. Prof. Dr. Hermann Wagner, who sums up Wolkenhauer's life and work in *Petermanns Mitteilungen* (April, p. 149), says that he had had it in view to turn over to Wolkenhauer a part of his own educational activities in the University of Göttingen.

Dr. Walther Hanns, who had just received his doctorate in the geographic seminar of the University of Leipzig, has been killed in battle near Craonne, France. He was a brilliant student and a young geographer of great promise.

POLAR

ARCTIC

Mr. Stefansson's Expedition. The Canadian government recently announced its intention of doing all that is possible to rescue Mr. Stefansson and his two companions, who went north early last year on the north coast of Alaska with a sledge and some supplies across Beaufort Sea and have not been heard of since sending back the last of the supporting party in April, 1914, details of which were printed in the *Bulletin* (Vol. 46, 1914, pp. 773-774). The Canadian government reports that its three steamers now in the Arctic will set out in search of the missing men as early as the break-up of the ice renders this practicable.

The Crocker Land Expedition. Several of the New York newspapers printed, on June 7, extracts from a letter received from Donald B. MacMillan, leader of the Crocker Land Expedition, which are interesting though they do not add very much to the information sent by Mr. MacMillan to the Museum of Natural History and printed in our *Bulletin* (Vol. 47, 1915, No. 1, pp. 52-53). There are some obvious misprints in the press reports. MacMillan is reported to have written that he covered the distance of 1,200 miles (more likely 300 miles or so if he traveled directly to and from the supposed position of Crocker Land) over the sea ice to and from Cape Thomas Hubbard in 72 days. He says that standing on the heights of Cape Thomas Hubbard, and for several days during his advance to the northwest over the Polar Sea, there was every appearance of an immense tract of land extending along 120° of the horizon and showing hills, valleys and snow-capped peaks. "Further travel towards the northwest caused it to change its position with the revolving of the sun. It constantly varied in extent and character and finally on our last march disappeared entirely." They reached the neighborhood of the supposed location of Crocker Land on April 23, 1914, when the meridian altitude and time sites gave the longitude as 108°22′ W. (which is some 3° west of the reputed position of Crocker Land), and lat. 82°30′ N. They returned to Cape Thomas Hubbard on April 28 and arrived at Etah on the Greenland coast, on the east side of Smith Sound, on May 21, a few days before the breaking up of the ice in Smith Sound.

The explorer says they planned, for the present year, a 1,500 mile trip to explore the region south of Ellef Ringnes and Amund Ringnes Lands. They intended to return by Jones Sound, to the south of Ellesmere Island, and ought to be back in Greenland waters by June 11. The *Bulletin* for June (p. 452) announced that the *George B. Cluett* had been chartered to bring the Crocker Land party home this summer. The vessel left New York on June 9 with Captain George Comer, Dr. E. O. Hovey and nine men in the crew.

Dr. W. S. Bruce in Spitzbergen. The *Bulletin* (Vol. 46, 1914, pp. 774 and 928) briefly noted Dr. Bruce's expedition to Spitzbergen last year. Further reports make it clear that the ice conditions practically prevented the carrying out of his researches. The chief purpose of his expedition was to make a hydrographic survey of Stor Fiord, but the heavy pack ice made it impossible for his party to enter it. He found also that the west coast of Spitzbergen generally was so heavily packed with ice masses that it was impossible to approach the coast. After he heard of the outbreak of the war he desisted from further efforts to carry out his plans and early in the fall returned to Edinburgh.

One Effect of the Eskimo's Diet of Tough Flesh. Mr. F. H. S. Knowles has a paper "The Glenoid Fossa in the Skull of the Eskimo" (*Geol. Surv. Mus. Bull. No. 9,* Anthropol. Series No. 4, 25 pp., ills. Ottawa, 1915), which gives an illustration of the physical effect upon the teeth and jaws of the Eskimo of the food to which his environment confines him:

"From all this evidence that I have been able to adduce I think it will now be readily granted: (1) that the food of the Eskimo is of an extremely tough nature and must need thorough mastication by very strong jaws; (2) that these people possess immensely powerful jaws and are from a very early age accustomed to make use of a strongly developed chewing method for the trituration of the tough substances constituting their ordinary diet; (3) that not content with the ordinary severe chewing use to which their jaws must be put, they regard as *bonne-bouche* substances which no ordinary jaws and teeth could make any impression upon; (4) that this chewing is, in the main, a widely extensive side-to-side movement of the mandible and reacts in varying degrees of intensity upon the form of their crania, mandibles, palates, and teeth."

GENERAL

Utilization of Solar Energy. The probable exhaustion, at the present rate of consumption, of the world's coal supply within a measurable time has led to the construction of various types of solar engines and motors designed to convert directly the sun's rays into motive power. A successful engine of this type is reported from Meadi, near Cairo, Egypt. It consists essentially of a series of parabolic reflectors in whose focus water receptacles are placed, in which steam is generated through the concentrated heat to which they are exposed. The total heat-receiving surface of the apparatus amounts to 1,000 square meters; in eight hours about 220 liters of water are evaporated. The engine develops about 50 horse power. The selection of Cairo as a site was due to its accessibility from Europe; it does not represent the ideal location, however, from the point of view of maximum production of energy. In the tropics such engines could very well compete with machines deriving their motive power from coal. Assuming 1 square meter to receive 1,800 calories per hour from the sun, enough heat strikes 1 square kilometer in the same time to equal the energy derived from the combustion of 1,000 tons of coal. Correspondingly the amount of radiation in the tropics during a year, if the sun shines uninterruptedly six hours a day, on an area of the size of Connecticut amounts to twenty times the total annual coal production of the world. (M. Amberg in *Himmel und Erde,* Vol. 27, 1915, No. 4.)

Recent Plankton Investigations. Newer methods developed by Lohmann of Kiel have made it possible to study the nature and distribution of even the most minute of the drifting organisms of the sea. These most miscroscopic of plankton are termed "nannoplankton" (from the Greek *nannos,* dwarf). A centrifugal apparatus is used consisting of conical vials containing the water samples which are revolved at a speed of 1,500 revolutions per minute. Even the smallest organisms are thus projected into the apex of the vials, from which they can be removed for examination under the microscope. Their diameter averages 2 to 15 microns. Their vertical distribution is dependent on the range of light. Their lower limit is thus placed at 100 fathoms; the great majority live near the surface, in depths not exceeding 10 fathoms. They predominate in shallow coastal waters, the mean ratio of frequency in these waters, as compared with the open sea, being 50:1. Their number is also much greater in cooler than in warmer waters. A liter of water from the western Baltic in summer contains on an average 2,500,000 diatoms; a liter from the Adriatic only 90,000. Inasmuch as fish are dependent on these organisms for food, this contrast is of economic significance to the countries concerned. From the Baltic and North Seas Germany derives a fish supply sufficient to form a regular article of food for her whole population, while the Adriatic fisheries suffice only to feed the coastal population (J. Schiller in *Die Naturwissenschaften,* Vol. 3, 1915, Nos. 16-17).

PERSONAL

Mr. Charles F. Brooks, of the U. S. Department of Agriculture, is visiting the Weather Bureau and Agricultural Experiment Stations throughout the southern, western, and central United States to study the geographical distribution of farm enterprises, the distribution of farm labor throughout the year and the climatic element involved. This trip is part of his work in the Office of Farm Management.

Mr. Henry G. Bryant of Philadelphia has returned from a journey which led him through the Panama Canal, down the west coast of South America with visits to Cuzco and La Paz, across the Andes and home via Buenos Aires and Rio de Janeiro. He says our business men have large opportunities there on the commercial side if they avail themselves of present favorable conditions; also that recent events are tending to draw the Spanish American republics into closer relations with their northern neighbors.

The Polynesian Society has elected Mr. William Churchill an Honorary Member. He has for many years been a Corresponding Member of the Society.

Prof. F. V. Emerson lectured before the Annual Convention of the Louisiana Public School Teachers' Association, Baton Rouge, on April 23, on "The Present Tendencies in Physical Geography"; and on April 24 before the Mississippi Valley Historical Association in New Orleans on "Some Geographic Influences in Mississippi Valley History."

Dr. Robert F. Griggs, Department of Botany at the Ohio State University, will lead an expedition this summer, under the auspices of the National Geographic Society, to study the vegetation of the Katmai district in Alaska. The purpose is to ascertain the means by which vegetation is gaining a foothold on the volcanic ash with which the country was covered by the eruption of Katmai in 1912.

Mr. T. Hirata was appointed to the Directorship of the Meteorological Observatory of the Government General of Korea upon the retirement of Dr. Y. Wada.

The Paris Geographical Society has made a special award of a gold medal to Dr. J. Scott Keltie for his long and distinguished services to geographical science.

Mr. C. E. Lesher, Associate Geologist of the Land Classification Board of the U. S. Geological Survey, has been assigned to take charge of compiling the statistics of coal production published in the annual volume "Mineral Resources."

Assistant Professor George E. Nichols of Sheffield Scientific School, Yale University, will continue work this summer on the ecology of the vegetation of northern Cape Breton Island which he began last summer.

Mr. Edward W. Parker, whose resignation from the Geological Survey is effective on July 1, has heretofore been in charge of the compilation of statistics of coal production in the annual publication "Mineral Resources."

Professor William North Rice, of Wesleyan University, will be engaged part of the summer in editorial work on the Bulletins of the Connecticut Geological and Natural History Survey which have been completed and are in course of publication.

Mr. G. B. Roorbach, of the University of Pennsylvania, is going to Venezuela during the summer vacation to study the effects of the war on industrial and commercial conditions in that country. He will make this investigation for the Carnegie Endowment for the Promotion of International Peace.

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

(The size of books is given in inches to the nearest half inch.)

NORTH AMERICA

The Indians of Greater New York. By Alanson Skinner. 150 pp. Map, index. (Little Histories of North American Indians, No. 3). The Torch Press, Cedar Rapids, Ia., 1915. $1. 8½ x 6½.

A scholarly, yet simple monograph, by the learned Assistant Curator of Anthropology of the American Museum of Natural History of New York, dealing with the native tribes, that formerly dwelt within the boundaries of what is known as Greater New York. The topics, treated briefly, but accurately, are the Indians of the Greater City, their manner of life, the customs of the Delawares, their contact with the Pale Face, their archæology, their relics. A bibliography and an index are appended. The first-hand sources of the history of the Indians of New York City are largely drawn upon, in reconstructing the Indian life in the present metropolis, such as the "Walum Olum" or Red Score of the Delawares, "The Remonstrance of New Netherland," the journal of De Vries, and the "Account of the Montauk Indians," by the Rev. Samson Occum, himself a Mohegan. Several common misapprehensions are corrected, such as that the costume of the Manhattan Indians was like that of the Sioux. In the archæological chapter of the work, many useful hints are given for the practical pursuit of the often despised, but ever victorious "science of the spade." Among these may be noted, the art of removing human remains from the strata in which they have lain for ages. A simple and clear explanation is given of the little understood meaning of the word wampum, or shell money of blue and white beads. The remains of Indian weapons, tools, utensils, and arts, are clearly and exhaustively catalogued. The particular sites formerly occupied by the Indians of Manhattan are also carefully located. All this is described in a plain and simple manner, which a man without technical archæological training can easily understand, and that, too, in less than 150 pages. It is a valuable contribution to the ante-European history of Greater New York. DAVID H. BUEL.

California the Wonderful . . . with Glimpses of Oregon and Washington. By Edwin Markham. xiv and 400 pp. Map, ills., index. Hearst's International Library Co., New York, 1914. $2.50. 8½ x 5½.

When the singer of the "Man with the Hoe" undertakes to write a history of California, the outcome is sure to be both imaginative and interesting. A poetic glamor of fine writing is cast over even the geological story of the state, and full justice is done to its cosmic grandeur. The same glow of enthusiasm throws a halo around the ethnology of the native tribes, while the spell of the romance of the old Spanish missions and conquistadors, as well as the golden era of '49, make the same appeal to the literary instincts of the writer that they did to Bret Harte. The exuberant growth of fruits and flowers, the wonders of the metropolis and the other important cities of the state, the picturesque scenery of shore and desert, and mountain, the graces and virtues of the women of California, the talent of its writers in prose and verse, the skill of its artists and scientists, and even the neighboring states of Oregon and Washington are pictured with a poet's pencil. D. H. B.

California: An Intimate History. By Gertrude Atherton. x and 330 pp. Ills. Harper & Brothers, New York, 1914. $2. 9 x 6.

The great value of this work lies in the essential element that it is in truth an intimate history. Mrs. Atherton joins to her skill in writing a fond per-

sonal acquaintance with many of the participants in the great era of the establishment of California as a state of remarkable individuality. It is not to be expected that all her opinions will be accepted with wholeheartedness, for she is forced to discuss debatable questions; but there can be no denying the fact that she has presented a vivid narrative. She knew many of the leading men of the state in the days of the gold discovery, she was able from important survivors of the old Mexican rule to secure valuable details of life under the mission fathers, she has been a part and a prophet of the modern growth of the new California which in this year is doubly celebrating its importance. This volume will be an entertaining commentary on the volumes of statistics which will be accumulated by visitors who bend their way to the two fairs in celebration of the Panama Canal. WILLIAM CHURCHILL.

Missionary Explorers among the American Indians. Edited by Mary Gay Humphreys. xii and 306 pp. Ills., index. Charles Scribner's Sons, New York, 1913. $1.50. 8½ x 5½.

The "Soldiers of the Cross," as the editor who compiles the life-stories of these Evangelical Missionaries calls them, bore no small part in opening up our country.. The career of the Puritan apostle of the Indians, John Eliot, is too well known to need comment. The life-work of Samson Occum, the full-blooded Mohegan Indian, shows the temper of his age. Thus the prominent Presbyterian clergymen and revolutionary patriot, Dr. Samuel Buell, of East Hampton, L. I., exclaims on the occasion of Occum's trial sermon as a Presbyterian minister: "He is the ornament of the Christian Religion, and glory of the Indian Nation." And Occum, himself, on a visit to England, writes of the Anglican Bishops, with Puritan view-point: "I think they a good deal resemble the Anti-Christian Popes." David Brainerd, a typical Independent, suffers expulsion from Yale College, rather than apologize for a criticism, made in private conversation, and reported to the faculty, of the private prayer of a college tutor. Marcus Whitman blazed the trail to Oregon, but in the end he and his wife were murdered by the Indian neophytes. Stephen Riggs and his wife evangelized the Sioux, and turned the Bible into their language. Colorado was the main field of John Lewis Dyer's effort, where he closed his career as chaplain of the State Senate. D. H. B.

The Fountain of Youth. By Charles Tenney Jackson. 343 pp. Ills. Outing Publishing Co., New York, 1915. $2. 8½ x 5½.

One of *Outing's* out-in-the-open tales, a conversational account of the wandering of two brain-fagged New York business men amid the bayous of Louisiana in a native dugout. Their Old Town, Maine, canoe, shipped from Boston, went down with the steamer that carried it. Their route took them from New Orleans, through the Barataria swamps to Grand Isle, and back. On one occasion a motor boat, known in the bayou patois as a "gazzoline," helped them on their way. At the Isle Dernière they recalled the hurricane of 1854, celebrated in the story of Lafcadio Hearn called "Chita." D. H. B.

The Scotch-Irish in America. By Henry Jones Ford. viii and 607 pp. Index. Princeton University Press, Princeton, N. J., 1915. $2. 8½ x 6.

A sympathetic tracing of the influence of the Scotch-Irish people in the formation and development of the United States, by the practiced hand of the able Professor of Politics at Princeton University. Although its subject-matter is very much the same as that of another book of similar character, recently noticed in these pages, it is based on original research into the British State Papers, bearing on the subject, with a view to throwing fresh light upon a topic that has been the subject of no little discussion. The settling of Ulster, by dispossessing the native inhabitants, and introducing another race with a different creed, is shown to be a particular instance of a not uncommon occurrence in history, the colonizing of a captured territory by a conquering race, and the deportation of the conquered people. The influences which formed a distinct type of racial character are pointed out, the emigration of the new strain to this country is described, the part played in Indian wars is made clear, the growth, as well as the beginning of the Presbyterian Church in

the United States, is explained, and then follows an account of Presbyterian educational centers, developed in different parts of the country, due prominence being given to the growth of Princeton University. It is worthy of note that the first settlement of Ulster men in this country seems to have been on the Eastern Shore of Maryland, in Lord Baltimore's colony. The outstanding impression that remains, after reading the book, is that the Scotch-Irish breed has played an unusually prominent part, in proportion to their numbers, in the religious, political, and educational progress of the United States, and that this prominence is largely due to their independent religious tendency. DAVID H. BUEL.

Lands Forlorn. The Story of an Expedition to Hearne's Coppermine River. By George M. Douglas. With an introduction by James Douglas. xv and 285 pp. Maps, ills., index. G. P. Putnam's Sons, New York, 1914. $4. 9 x 6½.

An attractive volume of interest both to the scientist and the general reader. It narrates the experiences of three young men, including the author, during eighteen months, without native guides, in the Arctic regions of Canada. Rumors among the Indians of extensive copper deposits in the far north had prompted the earlier exploration of this inhospitable region. Among the expeditions thither was that of 1769-1770 under the auspices of the Hudson Bay Company, commanded by Samuel Hearne. He found only one lump of copper, although he expected to find the metal "lying around in lumps like a heap of rocks." Hearne's unfavorable report and the inaccessibility of the region combined to destroy interest in the Coppermine River district for some time. A later description of this area was the result of Franklin's overland journey to the Arctic in 1819-1822. His primary object was geographical discovery; but one of the members of his party, in the opinion of Mr. Douglas, described, with some degree of accuracy, the area containing the copper deposits. Later explorers added to knowledge of the Coppermine River district; but largely because of the isolation of the deposits, their exploitation has been widely regarded as commercially impracticable.

But Mr. Douglas, who wished to explore one of the rivers flowing into the Arctic Ocean, chose the Coppermine chiefly because he believed his findings there might, in time, have commercial value. He and his companions brought back numerous samples of rocks some of which contained only traces of copper, while two others were of profitable grade. Perhaps their most important contribution was the mapping of the various beds of rocks in the copper-bearing area. But even with the new scientific data added by Mr. Douglas and his party, it is clear that "whether profitable ore occurs anywhere in this district can be determined only by a thorough survey, followed, should favorable indications be found, by exploratory development on an extensive scale."

The volume is illustrated by 180 photographs, a large sketch map, and a geological map of the lower section of the river prepared by Dr. August Sandberg, the geologist of the party. AVARD L. BISHOP.

History of Mexico. Being a popular history of the Mexican people from the earliest primitive civilization to the present time. By Hubert Howe Bancroft. vii and 581 pp. Map, ills., index. The Bancroft Co., New York, 1914. $2. 8 x 5½.

Thirty-five volumes, previously published on historical topics, concerning the Pacific slope, give the writer of this history of Mexico unusual experience and authority. The work will supply a long-felt want for the general reader; whether it will do the same, as the writer intends, for the historical scholar is more open to question. The perusal of the book makes it clear that under Toltec and Aztec rule, under the sway of Spanish conquistador and viceroy, under the domination of revolutionary despot, and intellectual cientifico, the peon of Mexico has been systematically down-trodden and exploited for the benefit of the moneyed and landed classes. The later chapters of the work dealing with contemporary happenings in Mexico, by which history is now

being made, will excite most interest, but it is well-nigh impossible, at present, to write an impartial history of events, even now in the making. The account does not favor the present factional leaders, or our policy. D. H. B.

Carranza and Mexico. By Carlo de Fornaro. [With chapters by Col. I. C. Enriquez, Charles Ferguson and M. C. Rolland]. 242 pp. Map, ills. M. Kennerley, New York, 1915. $1.25. 7½ x 5.

The author opposed General Diaz with his pen as Carranza did with his sword, with the result that he languished for some time in prison. This book is the story of Mexican conditions and of the resulting rebellion of Carranza, Madero and other patriotic leaders. The book is most informing, because it gives an inside view of the chaotic state of Mexico and the causes of it. It should be read by all who are interested in the recent troubled history of that unfortunate republic.

AFRICA

Enquête sur la Famille, la Propriété et la Justice chez les Indigènes des Colonies Françaises d'Afrique. 129 pp. Map, ills. Esquisse ethnologique des principales populations de l'Afrique équatoriale française. Par le Dr. Poutrin. Soc. Antiesclavagiste de France; Masson & Cie., Paris, 1914. 11 x 7½.

Étude Anthropologique des Populations des Régions du Tchad et du Kanem. Par R. Gaillard et L. Poutrin. (Extrait des Documents Scientifiques de la Mission Tilho. Vol. 3). 111 pp. Map, ills. É. Larose, Paris, 1914. 11 x 7.

These two monographs by Dr. Poutrin call for consideration in conjunction. The former is a general study of the negro population of equatorial Africa in their ethnologic relations, the latter is a close examination of their anthropologic position as determined by precise bodily measurements. Extensive as is the geographical range of the peoples concerned in this anthropometrical study, the monograph must amount to no more than one more contribution to the collection of similar data from Africa; it is only when we compare such data through a long suite of observations, when we have learned to apply the correction for peculiarities of nutrition and environment, that such material can be made to tell us a complete story of human affinities. The former monograph is a most interesting record, though painfully brief. Dr. Poutrin has sought to familiarize himself with the custom and with the history of the scores of tribes with whom he has been brought into contact in his exploration of the French colony of Equatorial Africa. In many cases, the tribes have been reduced to a mere handful of survivors, in many cases his opportunity for making the acquaintance of the savages was very short. But he shows himself a competent observer, he is quick to seize the salient character of the folk under examination and his never failing sympathy has succeeded in extracting from the most shy some note as to their history which may serve to establish their position within the tangle of races which is the resultant of the recent days of the terror of the slave raids. He has proved singularly alert in the recognition of those minor customs which may so readily pass the observer's note, yet which prove such important criteria in establishing the interrelation of widely separated tribes. WILLIAM CHURCHILL.

Egyptian Irrigation. By Sir W. Willcocks and J. I. Craig. 3d edit. Vol. 1: xxiv and 447 pp. Vol. 2: pp. 449-884. Ills., index. Spon & Chamberlain, New York, 1913. $12.50. 10 x 7½.

A third edition presenting many quotations from the first and second editions with annotations, so that the work is thoroughly modern. The volumes offer the fullest information obtainable of the Nile and its tributaries and provide a basis for the study of the problems of irrigation. Many pages of a technical nature will appeal only to engineers, but there are many sections of general interest which will aid not only in the interpretation of Egypt but also in the appreciation of the factors and function of irrigation. The introduc-

tory chapters contain a vast amount of general information about the valley, including the geology, meteorology, soil conditions, ground water, crops, transportation, population and commerce, and also concerning the river and its tributaries.

Full accounts may be found of the processes and historical development of the two kinds of irrigation used in Egypt; basin irrigation, or the ancient method of holding the flood waters over the valley for a period of days; and perennial irrigation, or irrigation from canals which supply water the whole year round. There is material here for the flood expert in the experiences with Nile floods and the effects of water storage on flood heights; for the student of soils in the analyses of resulting soils and the influences of water under different degrees of turbidity; for those interested in the commercial status of the valley and above all for the hydraulic engineer who has to deal with deposition of silt and bank erosion, barrages and dams. Besides, there are questions peculiar to the Nile which are extensively considered in these volumes: the interesting region of the sudd and the projects concerning it, the prevalence of basins which open up larger areas for occupancy and the problems of administration. ROBERT M. BROWN.

François Coillard. Missionaire au Zambèze 1882-1904. Par E. Favre. 572 pp. Map, ills., index. Soc. des Missions Évangéliques, Paris, 1913. Fr. 7.50. 10 x 6½.

It has been no part of the object of the editor of these interesting reminiscences to furnish a geographical record of the Zambezi country in which Coillard was a pioneer. Coillard has done that for himself in an earlier volume detailing his work of exploration. It has not been possible, however, to omit all geographical detail, for Coillard's letters and journals, here offered, describe the difficulties of the long trek out of South Africa and the dangers of canoe voyaging on the Zambezi. But the book especially describes the ethnology of the Barotse above the Victoria Falls, which was the missionary's particular interest. We thus have a somewhat minute and intimate study of the soul life, the psychology, of a savage folk at the time of their first contact with the higher culture. The work accordingly stands high in its appropriate place as a valuable introduction to the study of Barotse culture.

WILLIAM CHURCHILL.

AUSTRALASIA AND OCEANIA

Forschungen im Innern der Insel Neuguinea. (Bericht des Führers über die wissenschaftlichen Ergebnisse der deutschen Grenzexpedition in das westliche Kaiser-Wilhelmsland 1910). Von Leonhard Schultze. 100 pp. Maps, ills., index. *Ergänzungsheft Nr. 11 der Mitt. aus den deutschen Schutzgeb.* Berlin, 1914. Mk. 4. 13 x 10.

Ergebnisse der Südsee-Expedition, 1908-1910. Herausgegeben von G. Thilenius. Vol. 1: Der Kaiserin-Augusta-Fluss. By O. Reche. 488 pp. Map, ills. Hamburg. Wiss. Stiftung. L. Friederichsen & Co., Hamburg, 1913. 12 x 9.

These two works deal independently with the great stream which, in its eastward flow, very nearly bisects the territory of German New Guinea. The problem primarily set before Schultze was to run the boundary line between the lands of the Netherlands and Germany. His first task was to push inland from the north coast along the bounding meridian as far into the interior as it was possible to force his way in the company of the Dutch geographers with whom he shared the task of pioneering. In the pathless tangle of the mountain land he found himself engaged with the brook beginnings of a water system which seemed to have a general easterly direction. At the inconvenient distance from his seacoast base it was impossible to arrive at a satisfactory determination of this river system. Accordingly, he essayed the problem from the other end. He made a hurried reconnaissance up the Kaiserin-Augusta River in a steam vessel and beyond the head of such navigation in a launch. As his purpose was rather to identify the brooks whose acquaintance he had

made at their springs than to establish the position of the lower and more accessible river, he lost no time in pushing on to the head of navigation. Here he was quite successful, his riverine survey was linked with his earlier exploration along the meridian and we now are informed of the whole course of the river from its head-waters to the sea.

Reche, on the other hand, was commissioned to study the ethnology of the peoples of the river valley. He did not ascend as far as the geognostic work of Schultze had carried the earlier exploration, but he is more detailed in his reports of so much of the river course as he did cover, practically all of its alluvial valley. His interpreter was serviceable for a very few miles in the delta and beyond that brief limit it was impossible to establish any means of communication. For that reason, if for no other, we shall have to adopt a double standard in the consideration of his results. The record of observation seems very accurate. For every object collected he supplies data as to place of collection and enriches the record by full information as to all attendant circumstances, a valuable item which museum specimens sadly lack. But his interpretation of the various objects must be subject to later determination obtained in the slower progress of settlement when acquaintance with the many languages is obtained.

In one important particular we find ourselves heartily in accord with Reche, namely, the designation of this river. Schultze has adopted the name Sepik in slight correction of Full's (1909) name Sipik. This is known only at the mouth or rather at one of the mouths, another mouth is Kokuan, yet other names in use are Abschima and Azimar. These are not names of the river, they are but names for small stretches of the river as known to the folk of this or that hamlet. We cannot reckon how many such names there may be in the course of more than 600 miles of the system. In New Guiana there is no indigenous name for the whole stream. This is clearly a case where a European designation may properly be applied and the principles of priority sanction the name Kaiserin-Augusta. WILLIAM CHURCHILL.

A Winter Holiday in Fiji. By Robert Brummitt. 173 pp. Map, ills. C. H. Kelley, London, 1914. 2s. 7½ x 5.

This unpretentious little volume is interesting within the angle of the writer's vision. His purpose was to see the Methodist mission stations in Fiji on a holiday trip. He addresses a narrow sectarian audience, but his story is just that which will interest those readers and will stimulate contributions in support of the evangelical and educational work among the Fijians which Australian Methodism has long supported. His comments on Fijian life are interesting and his missionary hosts have prevented him from falling into gross error. The map of the islands, however, is crowded with mistakes.

WILLIAM CHURCHILL.

EUROPE

The Nations of Europe. The Causes and Issues of the Great War. A graphic story of the nations involved, their history, and former wars, their rulers and leaders, their armies and navies, their resources, the reasons for conflict and the issues at stake. By Charles Morris. 464 pp. Ills. J. C. Winston Co., Philadelphia, 1914. $1.50. 9½ x 7.

A popular handbook, narrating in the style of a newspaper article the outbreak of the present European conflict, its underlying causes, the strength and resources of the belligerents, and the race-struggle between Teuton and Slav. After this follows a condensed chronicle of the course of European diplomacy and warfare from the beginning of the last century up to the present time. Some, perhaps, may not agree with the writer's sense of historical values and perspective when, for instance, he devotes pages to the Charge of the Light Brigade, and the Battle of Magenta, while he assigns only paragraphs to the Italian occupation of Rome and the severance of the concordat between the Roman Curia and France. There are sixty-four pages of half-tone reproductions of admirals, diplomats, fleets, submarines, aeroplanes, famous battle scenes and troops of the Great Powers at maneuvers. DAVID H. BUEL.

A Leisurely Tour in England. By J. J. Hissey. xviii and 400 pp. Map, ills., index. The Macmillan Co., N. Y., 1913. $3. 9 x 6.

A motor trip along unfrequented highways in Southern England and Central Wales. The author has a predilection for quaint spots and buildings of romantic attributes, to many of which he conducts the reader. Thus the book teems with stories of an earlier time and recounts customs and scenes away from the busy thoroughfares. The itinerary is described in an interesting style and makes pleasant reading. The daily run and the evening halt told frequently in infinite detail contain no adventures, but there is enough of historical allusions and freshness of thought to hold the attention.

ROBERT M. BROWN.

Highways and Byways in Shakespeare's Country. By W. H. Hutton. With ills. by E. H. New. xvi and 448 pp. Map, index. The Macmillan Co., New York, 1914. $2. 8 x 5½.

The painstaking result of four years of patient, scholarly delving into the country of Shakespeare, its topography, its architecture as shown in church and castle, in manor-house and cottage, its woodland scenes and landscapes, its gossipy traditions prevalent among the inhabitants, and its literary allusions to the places visited. The skilled pencil of the artist had preceded the writer of these records, and the result is a number of tasteful sketches of the scenes and edifices described in the text. Lovers of the Bard of Avon will appreciate all the minutiæ of local history which throw light upon the poet's life and times. The chapters on Stratford, the birthplace, Coventry, and Kenilworth are most interesting. An excellent road-map of Warwickshire, with the roads and routes outlined in red, makes it easy to follow the writer on his tour. The work is marked throughout by a characteristically English recording of genealogical data.

DAVID H. BUEL.

The British Isles. By Frederick Mort. Maps, ills., index. 231 pp. University Press, Cambridge, 1914. 3s. 8 x 5½.

The geology, and physical and economic geography of the British Isles are first taken up. Then, the regional geology and geography of each part of the United Kingdom is described with some detail. The influence of the physiographic upon life and economic development is emphasized. The control of the inorganic over the organic is frequently shown, as for example, on page 164: "The position of the seats of cotton manufacture is controlled by a climatic factor. A moist climate is desirable. If the air is too dry the threads become brittle and are difficult to work. The west coast of Britain has a much wetter climate than the east, and so, in time, all the cotton-working towns have come to be in the west." He points out how the coal fields have helped to determine the location of the cotton manufactures, and adds: "As we pass to the southeast of the Lancashire cotton towns, the climate becomes drier, and there is a corresponding change in the textile that is manufactured. Cotton gives place to silk." The book should be used with good orographical maps of the British Isles. Excellent illustrations, maps, graphs and tables aid the text.

WILBUR GREELEY BURROUGHS.

Britannia's Growth and Greatness. An Historical Geography of the British Empire. By A. J. Berry. 304 pp. Maps, ills. I. Pitman & Sons, London, 1914 (?). 2s. 7½ x 5.

The history of the development of each part of the British Empire is told, the control of the physiographic over the organic being emphasized. Of the Northern Territory of Australia, Mr. Berry says the climate is not unhealthy for whites if they take sufficient exercise. The land is offered very cheaply as an inducement to settlers. He thinks this is a promising opening for the farmer. "The land is well watered and the rainfall sufficient. Cattle-breeding, wherever it has been tried, has succeeded." The author shows how the various parts of the Empire are bound together. The book is readable and contains many illustrations.

WILBUR GREELEY BURROUGHS.

Glasgow Rivers and Streams: Their Legend and Lore. By T. C. Brotchie. xxv and 150 pp. Ills. J. MacLehose & Sons, Glasgow, 1914. 2s. 6d. 8 x 5½.

The story of the rambles of a Scot, amid the rivers and streams of Glasgow, up to the sources of the Clyde. The sixty sketches from the writer's pencil are a welcome relief from the usual half-tone reproductions of photographs, excellent though they be, which illustrate present-day accounts of travel. The introductory essay upon water-lore, as exemplifying the testimony of folk-lore to the prevalence of superstitution, from the origin of the human race until now, is as welcome as it is unusual in books of this kind. The writer acknowledges in foot notes the authorities for his statements of fact.

David H. Buel.

GENERAL

The Earth: Its Genesis and Evolution. Considered in the light of the most recent scientific Research. By A. T. Swaine. 227 pp. Ills., index. C. Griffin & Co., London, 1913. 7s. 6d. 9 x 5½.

This volume is an attempt to present the conclusions of various scientists concerning the origin of the earth and, at the same time, to present a few notions of the author. The first two chapters deal with the various hypotheses of the origin of the earth and present the problem. The next six chapters are given to the processes involved in rock formation. The following twenty chapters treat the successive geologic periods. A number of good photographs and diagrammatic cross-sections accompany the text.

The author has not succeeded very well in accomplishing something worth while. The compilation is not one of rare materials or even information that is ordinarily difficult of access. The book contains essentially nothing sufficiently different from the usual to warrant its addition to the present literature on the subject.

Eugene Van Cleef.

Trees in Winter. Their Study, Planting, Care and Identification. By A. F. Blakeslee and C. D. Jarvis. 446 pp. Ills., index. The Macmillan Co., New York, 1913. $2. 8½ x 6.

Most recent books and manuals dealing with forests and forest trees describe our eastern trees in their summer garb and, only incidentally, in their winter condition. The increase in the number of persons interested in trees, recruited from our high schools, agricultural colleges, etc., requires attention to the winter conditions of trees when schools and colleges are in session. Dr. Blakeslee, professor of botany and director of the summer school of the Connecticut Agricultural College, and Dr. Jarvis, horticulturist at the Storrs Experiment Station, supplied this information in *Bulletin* 69 (June, 1911), issued by the Storrs Agricultural Experiment Station. It met such an instant demand that copies of it are extremely hard to procure; but fortunately the Macmillan Company republished it in this book, with additional chapters. The copies include an introduction on the study of trees, and chapters on their structure, life, growth and propagation, tree-planting in rural districts, towns and cities, the selection of trees for special purposes, the care of trees, common injuries to shade trees, the control of parasites, insecticides, fungicides and spraying. The second part of the book, on the identification of trees in winter by means of descriptions and analytic keys, is practically a reprint of the original *Bulletin*.

The illustrations add greatly to the value of the text. The photographs of twigs and fruit of the deciduous trees are nearly natural size. Line drawings are used also with judgment and the photographs have been carefully selected. The book can be recommended to those who wish to study trees, when they are in a resting condition and those who desire to plant trees before the leaves have appeared or to identify them by their bark, buds, leaf scars and branch tracery during the leafless period. It will also serve as a useful reference text until some botanist undertakes to publish careful descriptions of all our forest trees at all seasons of the year.

John W. Harshberger,
University of Pennsylvania.

OTHER BOOKS RECEIVED

These notes do not preclude more extended reference later

NORTH AMERICA

STORIES OF OLD KENTUCKY. By Martha G. Purcell. 192 pp. Map, ills. American Book Co., New York, 1915. 66 cents. 7½ x 5.

ON THE SHORES OF AN INLAND SEA. [The inshore route from Puget Sound to Sitka.] By J. T. Dennis. 79 pp. Ills. J. B. Lippincott Co., Philadelphia, 1895. 8 x 5.

HEATON'S ANNUAL. The Commercial Handbook of Canada and Boards of Trade Register. 11th Year. 1915. Edited by Ernest Heaton and J. B. Robinson. Associate Editor, W. J. Dobson. 514 pp. Index. Heaton's Agency, Toronto, 1915. $1. 7½ x 5.

CENTRAL AMERICA AND WEST INDIES

THE FLORA OF CURAÇAO, ARUBA AND BONAIRE. By I. Boldingh. (Vol. 2 of the Flora of the Dutch West Indian Islands.) xiv and 197 pp. Ills. E. J. Brill, Leiden, 1914. $1.80. 10 x 7.

A MONTANE RAIN-FOREST. A Contribution to the Physiological Plant Geography of Jamaica. By Forrest Shreve. 110 pp. Ills. *Carnegie Inst. Public. No. 199.* Washington, D. C., 1914. $1.50. 10 x 7.

SOUTH AMERICA

RUND UM SÜD AMERIKA. Reisebriefe von Oskar v. Riesemann. 191 pp. D. Reimer (E. Vohsen), Berlin, 1914. Mk. 4. 9½ x 6½.

(a) DESCRIPCIÓN DE LA PATAGONIA. Por el P. Tomás Falkner. [A Description of Patagonia, and the adjoining parts of South America: Containing an account of the soil, produce, animals, vales, mountains, rivers, lakes, etc., of those countries; the religion, government, policy, customs, dress, arms, and language of the Indian inhabitants and some particulars relating to Falkland Islands. By Thomas Falkner. Hereford, 1774.] (b) Vida entre los Patagones. Por G. Ch. Musters. Vol. 1. Traducción, anotaciones, noticia, biografica y bibliográfica por el Dr. Samuel A. Lafone Quevedo. 392 pp. Maps. Univ. de la Plata, Buenos Aires, 1911. 11 x 7½. [A Spanish translation of the original English editions.]

AFRICA

A CAMERA ACTRESS IN THE WILDS OF TOGOLAND. The adventures, observations and experiences of a cinematograph actress in West African forests whilst collecting films depicting native life and when posing as the white woman in Anglo-African cinematograph dramas. By Miss M. Gehrts. With an introduction by Major H. Schomburgk. xx and 311 pp. Map, ills. J. B. Lippincott Co., Philadelphia, 1915. $3. 9 x 6.

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GENERAL

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NEW MAPS

EDITED BY THE ASSISTANT EDITOR

For system of listing maps see p. 75 of this volume

AFRICA

Nigeria. The Eket District, Southern Provinces of Nigeria, from a survey by P. Amaury Talbot, B.A., 1913. 1:150,000. 4°58′ - 4°31′ N.; 7°47′ - 8°21′ E. 2 colors. With inset showing location of main map. 1:5,000,000. 8° - 4° N.; 3° - 9° E. 2 colors. Accompanies "The Land of the Ibibios, Southern Nigeria," by P. A. Talbot, *Geogr. Journ.*, Vol. 44, 1914, No. 3, pp. 286-306.

[District forms part of the delta of the Niger lying just west of the Cross River. No relief is shown, as the greater part of the district is below 50 ft.; the coastal areas are amphibious.]

ASIA

Caucasia. A Geological Map of the Caucasus, compiled from the latest sources by Felix Oswald, D.Sc., B.A., F.G.S., F.R.G.S., (Probate Registrar, Nottingham). 1:1,000,000. 46° - 39⅙° N.; 36° - 51° E. Oriented N. 31° W. 20 colors. Accompanied by "Explanatory Notes to Accompany the Geological Map of the Caucasus, by Felix Oswald," Dulau & Co., London, 1914.

[Important geological map of the Caucasus on one and a half times as large a scale as the corresponding sheets (Nos. 34-35: FV - GV) of the standard International Geological Map of Europe, 1:1,500,000. On the whole, the formations are differentiated in greater detail. For instance, the Lower Jurassic of the international map along the northern slope of the Western Caucasus is expanded into Lower and Middle Jurassic; while the whole crystalline and granitic core of the range is more minutely subdivided. Fourteen formations and six types of igneous rocks are distinguished. The main divide

is shown in black. The accompanying booklet does not give the sources. The drafting and printing of the black plate are not as neat as the content would warrant.]

Caucasia. Karte des Kaukasischen Hochgebirges und der angrenzenden Gebiete von Cis- und Trans-Kaukasien. Auf Grundlage der russischen Generalstabskarten und Messtischblätter sowie nach seinen photographischen Aufnahmen und Beobachtungen bearbeitet von Moriz von Dechy. 1:400,000. 2 colors. In two sheets; Blatt I: Westlicher und Zentraler Kaukasus. 44°6′ - 42°7′ N.; 39°54′ - 44°42′ E. Blatt II: Östlicher Kaukasus. 43°31′ - 41°0′ N.; 44°24′ - 48°33′ E. Each sheet with inset showing extent of the two sheets: Orientierungskarte. 1:10,000,000. 46° - 39° N.; 36° - 51° E. 1 color. Engraved by Kartogr. Anstalt, G. Freytag & Berndt, Vienna. Accompanies, in pocket of Vol. II, "Kaukasus: Reisen und Forschungen im kaukasischen Hochgebirge" (in 3 vols.) by M. Déchy, Berlin, 1906.

[Valuable map affording a good general view of the whole Caucasus system except for its extreme western and eastern ends, while at the same time showing a considerable amount of detail, due to the relatively large scale. It is based on the 1:42,000 sheets of the map published by the Military Topographical Bureau at Tiflis. Relief is shown in excellent shading in brown, glaciers in blue. In this connection reference should also be had to the map with the same main title by G. Merzbacher, 1:140,000, accompanying his "Aus den Hochregionen des Kaukasus," 1901 (cf. *Bull.*, Vol. 33, 1901, pp. 469-470), which, in keeping with its larger scale, shows only a section of the summit region—from Mt. Elbruz to Mt. Addala (46¼° E.)—and in much greater detail.]

Mongolia. Map of the Turgun or Kundelun Mountains in North-west Mongolia from a plane-table survey by Douglas Carruthers, 1910, with material added on the south-eastern slopes from Sheet XIII of the Russian Government Map of the Southern Frontier Regions of Asiatic Russia. 1:350,000. 50°21′ N. - 49°17′ N.; 90°19′ - 92°0′ E. 5 colors. Accompanies "Further Information on the Turgun or Kundelun Mountains in North-western Mongolia, and Notes on a New Map of This Region" by D. Carruthers, *Geogr. Journ.*, Vol. 44, 1914, No. 4, pp. 382-385.

[Detail of the highest portion of one of the Mongolian basin ranges to the east of the Altai. Its general relationship was shown on the author's map in 1:2,000,000 listed under "Mongolia-Siberia (a)" in the *Bull.*, Vol. 45, 1913, pp. 559. Relief in approximate contours (interval 500 ft.) and shading in brown, perpetual snow and glaciers in blue, author's route in red.]

Mongolia-Siberia. (a) Sketch Map of the Siberian-Mongol Frontier Showing Racial Distribution on the Russo-Chinese Borderlands by Douglas Carruthers. 1:7,500,000. 58° - 39° N.; 70° - 112° E. 3 colors.

(b) Alpine Region of Karlik Tagh. [1:215,000.] [43° N. and 94¼° E.]

(c) Map Showing Life Zones of North-west Mongolia and Dzungaria. [1:12,000,000.] 53° - 42° N.; 79° - 102° E.

Accompany, facing p. 350 and on pp. 623 and 625 respectively, Vol. II of "Unknown Mongolia" (2 vols.) by D. Carruthers, London, 1914.

Map (a) shows in red, on the map listed under "Chinese Empire" (second entry) in the *Bull.*, Vol. 44, 1912, p. 638, as a base, the names and the limits of distribution of the native races. Map (b) is a black-and-white detail of the relevant section of the map listed under "Mongolia-Siberia (b)" in the *Bull.*, Vol. 44, 1913, p. 559. The following divisions and subdivisions are distinguished: (1) Siberian zone; (2) Central Asian zone, (a) Tian Shan subdivision, (b) Mongolian subdivision; and, in addition, two transitional zones, Siberian-Mongol and Altai-Tian Shan. The other maps accompanying this admirable work have already been listed under the two headings referred to when they were published in the *Geogr. Journ.*]

Tibet-India. Part of North-Eastern Frontier and Tibet showing the route of Captains Morshead and Bailey, 1913. 1:1,000,000. 30°15′ - 27°15′ N.; 91°30′ - 96°0′ E. 2 colors. With inset, 1:15,000,000, showing location of

main map. Accompanies "Exploration on the Tsangpo or Upper Brahmaputra" by F. M. Bailey, *Geogr. Journ.*, Vol. 44, 1914, No. 4, pp. 341-364.

[Important reconnaissance survey (relief in brown shading; drainage in blue) in that ill-known eastern end of the Himalayas where the range is enclosed on three sides by the big bend of the Brahmaputra. The survey extended from the bend in 95½° E. up the upper Brahmaputra (or Tsangpo) to beyond 92° and included a large tract extending nearly two degrees in latitude southwest from the western half of the explored portion of the river. The main interest of the expedition lies in the fact that it practically completed the survey of the bend of the river, which establishes the identity of the Tsangpo with the Dihang and, thus, with the Brahmaputra. The lower portions of the bend were surveyed in 1913 on the Abor expedition under Capt. O. H. B. Trenchard, mentioned in the article on this topic in the April *Bulletin* (Vol. 47, pp. 259-264; map see under "India-Tibet," Vol. 45, pp. 396-397), which ascended the Dihang to Yortang (29°15′ N. and 95°10′ E.) and then cut across the tip of the bend to Phea Doshung (29°30′ N. and 94°50′ E.). The tip of the bend was reached by Captains Morshead and Bailey from the valley of the Dibang (a short south-flowing stream entering the Brahmaputra just below its exit from the mountains), up which they traveled with the Mishmi expedition under Capt. C. P. Gunter (*Records Surv. of India*, Vol. IV, pp. 17-38). They traced the eastern and western portions of this tip, but were forced to leave unsurveyed an intervening gap of 15 miles in an air line. This insignificant gap does not affect the fact that the course of the Brahmaputra where it cuts through the Himalayas has at last been established by these Survey of India expeditions. We now know, as shown on the map in the April *Bulletin* (p. 260), that in cutting across the range the river first flows northeast from about 94° E. on and then doubles back on itself and flows southwest, enclosing the "tip" referred to, before finally entering on its transverse course southeast which carries it across and out of the mountains.]

Turkey in Asia. Taurus Section of the Baghdad Railway (Karapunar to Dorak) to illustrate the paper by Capt. S. F. Newcombe, R.E., and Lieut. J. P. S. Greig, R.E., 1:400,000. 37°38′ - 36°44′ N.; 34°23′ - 35°25′ E. 1 color. Accompanies "The Baghdad Railway" by S. F. Newcombe and J. P. S. Greig, *Geogr. Journ.*, Vol. 44, 1914, No. 6, pp. 577-580.

[Relief in brown. Based on Kiepert's "Karte von Kleinasien" on the same scale.]

POLAR

Antarctic. (a) Regional Map showing the area covered by the Australasian Antarctic Expedition, 1911-14, under Sir Douglas Mawson, including tracks of the "Aurora" and most of the deep-sea soundings. 1:15,000,000. 35° - 75° S.; 80° E. - 170° W. 1 color.

(b) King George V Land showing tracks of the Eastern Sledging Parties from the Main Base. 1:1,000,000. 66°30′ - 69°10′ S.; 142° - 153° E. 2 colors.

(c) Queen Mary Land showing tracks of the Sledging Parties from the Main Base. 1:1,500,000. 63°50′ - 67°40′ S.; 86° - 102° E. 2 colors.

(d) Macquarie I. 1:200,000. [55° S. and 159° E.]

(e) The North End of Macquarie Island. [1:64,000.] [55° S. and 159° E.]

(f) Map showing the remarkable distribution of islets fringing the coastline of Adélie Land in the vicinity of Cape Gray. [1:200,000.] [66⅚° S. and 143⅓° E.]

(g) Map showing track of the Southern Sledging Party from the Main Base. 1:3,000,000. 66½° - 71° S.; 141½° - 148° E.

(h) Adélie Land showing tracks of the Western Sledging Party from the Main Base. 1:1,500,000. 65⅚° - 67⅜° S.; 137° - 143° E.

(i) Ships' Tracks in the Vicinity of Totten's Land and North's Land. [1:3,800,000.] 63° - 67° S.; 117½° - 130°E.

(j) Ships' Tracks in the Vicinity of Knox Land and Budd Land. [1:3,300,000.] 64° - 67° S.; 103½° - 114½° E.

All maps, except (e), (i) and (j), accompany both "Australasian Ant-

arctic Expedition, 1911-1914" by D. Mawson, *Geogr. Journ.*, Vol. 44, 1914, No. 3, pp. 257-286, and "The Home of the Blizzard" (2 vols.) by D. Mawson, Philadelphia and London, 1915: maps (a), (b) and (c) separately and maps (d), (f), (g) and (h) in the former on pp. 263, 271, 273 and 277 respectively and in the latter on pp. 31 (Vol. I), 5 (II), 279 (I) and 15 (II). Maps (e), (i) and (j) accompany the latter alone, on pp. 177 (Vol. II), 73 and 75 (1) respectively.

[These maps embody the geographical results of the Australasian Antarctic Expedition. Map (a) is a general map showing the expedition's field of exploration on the Antarctic continent, which extended over no less than 63 degrees of longitude (89° - 152° E.), and the tracks of the *Aurora* on her various cruises. Maps (b) and (c) are large-scale maps of the eastern and western ends, respectively, of the area explored, and are the most important in the series. Map (d) is a valuable black-and-white map constituting the first satisfactory topographical survey of this sub-Antarctic island (relief in contours; interval 200 ft.), the only previously existing survey, that of the British Admiralty (Chart No. 1022), being inaccurate and naturally slighting the interior. Map (e) shows the northern end of the island in greater detail with a contour interval of 50 ft. Maps (e), (f) and (g) are black-and-white sketch maps; on map (f) the magnetic dip and declination on the stations of the southern sledge journey are given. Maps (i) and (j) show the tracks of Mawson's *Aurora* as compared with the vessels of the Wilkes Expedition off Knox, Budd, Totten and North Lands.]

Other Maps Received

NORTH AMERICA

Canada

British Columbia. Geological Survey of Canada. Map 70A, Victoria sheet, Vancouver Island; 72A, Saanich sheet, Vancouver Island. 1:62,500. Geological Survey, Department of Mines, [Ottawa], 1914.

United States

Alabama. State of Alabama, compiled from official records of the General Land Office, U. S. Geological Survey, and other sources, under the direction of I. P. Berthrong, Chief of Drafting Division. 1 in. to 12 mi. (1:760,320). General Land Office, Department of the Interior, Washington, 1915.

Massachusetts. Plan for development of Boston harbor. 1:20,000. Accompanies "Supplementary Report of the Directors of the Port of Boston to the General Court," Boston, 1915.

New York. The Matthews-Northrup new map of the city of Buffalo. 1:15,840. [Matthews-Northrup Co., Buffalo, 1914?].

Map of the city of New York, compiled and prepared in conformity with the directions of the Board of Estimate and Apportionment. 1:24,000. Board of Estimate and Apportionment, [New York], 1915.

Boroughs of Manhattan and the Bronx, showing the distributing mains of the New York Edison Company. 3½ in. to 1 mi. (1:18,000). The New York Edison Co., New York, 1913.

Pennsylvania. Map of Pennsylvania, showing state highways as adopted under the Sproul Road Bill. 1:380,000. [State Highway Commissioner, Harrisburg, Pa.], 1911.

Utah. State of Utah, compiled from the official records of the General Land Office and other sources under the direction of I. P. Berthrong, Chief of Drafting Division. 1 in. to 12 mi. (1:760,320). General Land Office, Department of the Interior, Washington, 1915.

West Virginia. Logan and Mingo Counties. 1:62,500. [Two maps]: 1, showing topography; 2, showing general and economic geology. West Virginia Geological Survey, [Morgantown], 1914.

SOUTH AMERICA

Argentina. Map of Patagonia, showing Capt. Musters' route. 1:5,700,000. Accompanies ''Vida entre los Patagones'' by G. Ch. Musters, in Tomo 1 [of Biblioteca Centenaria], Buenos Aires, 1911.

AFRICA

Africa. Afrika. 1:10,000,000. Insets: Östlicher Teil von Deutsch-Ostafrika, 1:5,000,000; Küstengebiet von Kamerun, 1:2,500,000. L. Friederichsen & Co., Hamburg, [1914].

Anglo-Egyptian Sudan. The Anglo-Egyptian Sudan. 1:3,000,000. Geogr. Sec., Gen. Staff, War Office, London, 1914.

Africa. 1:250,000. Sheets: 55L, Doka; 78C, Akobo; 86C, Madial. The Survey Office, Khartoum, 1914. [Printed on cloth.]

Mediterranean Sea. C. Ivi to Algiers, Algeria, Mediterranean. From French surveys between 1867 and 1870. [1:300,000]. U. S. Hydrographic Office, Washington, Feb. 1915. Chart No. 3984.

ASIA

Afghanistan. Afghanistan sheet, southern Asia series. 1:2,000,000. Survey of India, Calcutta, 1914.

Baluchistan. Baluchistan sheet, southern Asia series. 1:2,000,000. Survey of India, Calcutta, 1914.

Korea. Übersichtskarte der Eisenbahnen in Korea (Chosen). 1:3,300,000. Accompanies ''Die Eisenbahnen in Korea (Chosen: Dschosön)'', by Landrichter Dr. Preyer, Julius Springer, Berlin, 1914.

Philippine Islands. Map of Leyte, P. I. 1:200,000. Geographical Division, Bureau of Coast & Geodetic Survey, Manila, 1914.

Map of central Luzon. 1:200,000. Geographical Division, Bureau of Coast & Geodetic Survey, Manila, 1912.

Map of southern Luzon, western sheet. 1:200,000. Bureau of Coast & Geodetic Survey, Geographical Division, Manila, 1913.

Map of Panay, P. I. 1:200,000. Geographical Division, Bureau of Coast & Geodetic Survey, Manila, 1912.

Map of Islands of Tablas, Romblon and Sibuyan, P. I. 1:200,000. Geographical Division, Bureau of Coast & Geodetic Survey, Manila, 1913.

EUROPE

Central Europe. Strategic map of central Europe showing the international frontiers. 1:2,280,960. [Four sheets.] War College Division, General Staff, War Department, Washington, 1915.

Mediterranean Sea. Adra to Cartagena, southeast coast [of] Spain, Mediterranean. From Spanish surveys to 1890. [1:260,000.] U. S. Hydrographic Office, Washington, Feb. 1915. Chart No. 3930.

Cape Tortosa to Cape St. Sebastian, east coast [of] Spain, Mediterranean. From Spanish surveys to 1893. [1:225,000.] U. S. Hydrographic Office, Washington, Feb. 1915. Chart No. 3933.

Cape St. Sebastian to Cette, south coast [of] France and Spain. From the latest French and Spanish surveys. [1:160,000.] U. S. Hydrographic Office, Washington, Feb. 1915. Chart No. 3934.

Alicante to Palamos with the Balearic Isles, southeast coast [of] Spain. From Spanish surveys to 1911. [1:660,000.] Insets: Vinaroz; Peñiscola Road, Javea Bay, Morayra Bay, Cape Anchorages, Port Soller. U. S. Hydrographic Office, Washington, Feb. 1915. Chart No. 3916.

Cette to Marseille, south coast [of] France, Mediterranean. From the latest French surveys. 1:150,000. Inset: Port of Cette, 1:12,500. U. S. Hydrographic Office, Washington, Feb. 1915. Chart No. 3935.

Gulfs of Lyons and Genoa, Mediterranean. From French and Italian surveys to 1912. [1:625,000.] U. S. Hydrographic Office, Washington, Feb. 1915. Chart No. 3917.

C. Cavallo to Civita Vecchia and adjacent islands, west coast [of] Italy. From French and Italian surveys to 1912. [1:255,000.] Insets: Port Vecchio di Piombino; Port Santo Stefano; Talamone Bay; Port Ercole. U. S. Hydrographic Office, Washington, Jan. 1915. Chart No. 3939.

Civita Vecchia to Naples, west coast [of] Italy, Mediterranean. From Italian surveys between 1883 and 1888. [1:260,000.] U. S. Hydrographic Office, Washington, Feb. 1915. Chart No. 3943.

Policastro to Cape Sta. Maria di Leuca, including the Strait of Messina, south coast of Italy. From Italian surveys to 1913. [1:410,000.] Insets: Cape Rizzuto Anchorage; Cotrone and Cape Colonne Anchorages; Port Cotrone; Sta. Maria di Leuca. U. S. Hydrographic Office, Washington, Feb. 1915. Chart No. 3951.

Grossa I. to Zirona channel, Adriatic. From Austrian surveys to 1900. [1:140,000.] Insets: Port Rogoznica, Port Capocesto; Pasman Strait; Port Zara; Port Tajer. U. S. Hydrographic Office, Washington, Feb. 1915. Chart No. 3957.

Channels of Corfu with the adjacent coast of Albania from Cape Kiephall to Kastrosika, Ionian Sea, Mediterranean. From British surveys in 1863 and 1864. [1:160,000.] Insets: Paxo Port Gayo; Port Gomenizza; Port Parga; Ports Alipa and St. Spiridione; Port S. Giovanni; Port Phanari. U. S. Hydrographic Office, Washington, Feb. 1915. Chart No. 3960.

North Sea. Jade River and Weser River entrance, Germany. From German surveys to 1913. [1:55,000.] U. S. Hydrographic Office, Washington, Feb. 1915. Chart No. 4860.

Jade River to Norder Piep, including the entrances to the Jade, Weser and Elbe Rivers, North Sea. From German surveys to 1912. [1:100,000.] U. S. Hydrographic Office, Washington, Feb. 1915. Chart No. 4861.

Russia. Stanford's railway map of European Russia. 1:3,220,177 [*sic*]. Edward Stanford, Ltd., London, 1915.

Carte hypsométrique de l'Empire Russe. Essai de représentation du relief de l'Empire par J. de Schokalsky. 1:12,600,000. [Lettering on map in Russian.] A. F. Marks, Petrograd, [1915?]. [Gift from the author.]

Spain. Plano de Valladolid, facilitado y revisado por el ayuntamiento. 1:8,000. A. Martin, Editor, Barcelona, 1915.

[Province of] Zamora. 1:400,000. Alberto Martin, Editor, Barcelona, 1915.

WORLD AND LARGER PARTS

Roman Empire. Johnstons' series of maps of ancient geography. (1) Orbis Romanus, [1:4,500,000]; (2) to illustrate Cæsar de Bello Gallico, 1:570,000. W. & A. K. Johnston, Edinburgh, [1914?].

WALL MAPS

North and South America. Schulwandkarte von Nord-Amerika, bearbeitet von Dr. Hermann Haack. Physische Ausgabe. 1:6,000,000. Justus Perthes, Gotha, [1914?].

Schulwandkarte von Süd-Amerika, bearbeitet von Dr. Hermann Haack, Physische Ausgabe. 1:6,000,000. Justus Perthes, Gotha, [1914?].